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THIRTY-THIRD ANNUAL CONVENTION.

MASTER CAR BUILDERS' ASSOCIATION.

The convention was called to order at 10 A. M., June 14, at Hotel Chamberlain, Old Point Comfort, Va., by the President, Mr. C. A. Schroyer. The session was opened with prayer by the Rev. J. J. Gavit, of Richmond, Va., after which Mr. Chas. T. O'Farrell, ex-governor of the State of Virginia, delivered an eloquent address which was full of patriotic enthusiasm and felicitation concerning the result of the recent war, the entire time covered by which was but 103 days. This, and the wonderful progress of this country was largely due to the influence of mechanical men and the important position of the country politically and commercially was chiefly brought about by the men whom the speaker addressed.

The courtesies of the army post at Fortress Monroe were then extended to the association by Col. Gunther, Commandant, which was followed by the address of President Schroyer, who began with the statement that the value of the cars represented by the association now amounted to over $500,000,000, which fact conveyed an idea of the responsibilities involved. The improvement in the harmony in the interchange of cars was indicated by the fact that but 35 cases had been brought before the arbitration committee for ruling. The speaker briefly reviewed the reports of the various committees and expressed his satisfaction with the good condition of the association generally.

The report of the Secretary contained the usual statistics and showed the membership to be as follows: Acting members 260, representative members 191, and associate members 7; a total of 458. The cash balance of funds handed over to the treasurer was $458. The treasurer reported funds on hand amounting to $8,893.12, all bills having been paid. It was voted to allow the membership dues to remain as last year, $4.00 per vote. After the appointment of a committee on nominations and an auditing committee Mr. J. O. Goben, Master Car Painter of the "Big Four" Railroad, addressed the meeting on behalf of the Master Car Painters' Association, urging closer cooperation between the two associations and enlisting assistance and encouragement for the M. C. B. Association. The matter was ordered referred to the committee on subjects for the convention of 1900.

Mr. McConnell presented a report of the conference between the executive committees of the M. C. B. and M. M. associations consisting of a recommendation which was in effect as follows:

That the time of holding both conventions should be changed to the second Tuesday in June.

That a joint opening session of both associations should be held at 10 o'clock A. M. of that day to hear the addresses, including the addresses of the presidents of both associations and the annual reports of the treasurer and secretary of the two associations. After this is over—

The Master Mechanics' Association to have the time up to 1 P. M. Tuesday.

The Master Car Builders' Association to have Tuesday afternoon.

The Master Car Builders' Association to have all of Wednesday.

The Master Mechanics' Association to have Thursday A. M.

The Master Car Builders' Association to have Thursday P. M.

The Master Car Builders' Association to have Friday A. M.

The Master Mechanics' Association to have Friday P. M.

If any further time is required by either association it can be available on Saturday, but it is not thought that this will be necessary.

The order of business of the joint meeting on Tuesday morning is to be arranged jointly by the presidents of the two associations, and to be published in the programme for both conventions.

After a brief discussion the subject was deferred for decision until the closing session.

Topical Discussions.

No. 1. "Is a lock set and knuckle opening device in M. C. B. automatic couplers essential to completely fulfill all the requirements of an automatic coupler?"

Opened by Mr. W. S. Morris. The law did not include the knuckle opener and lock set (a lock to the lock, to prevent accidental unlocking on the road) but stopped at the automatic coupling of the couplers. The speaker, however, considered these attachments important and necessary. Mr. Bush supported Mr. Morris in the opinion that couplers should be so equipped as to avoid the necessity for men to pass between the cars in coupling or uncoupling them.

No. 2. "In the interchange of passenger equipment cars, what is and should be the practice in regard to charging for Pintsch gas in cars lighted by this system?"

Mr. G. W. Rhodes presented the subject and suggested the use of the M. C. B. defect card for the amount of gas measured in atmospheres, for the pressure registered by the gage on the car and recommended that this should be included in the rules for the interchange of passenger cars.

No. 4. (Third subject deferred.) "Has the splicing of air brake hose been found to be good and economical practice, and should cars so equipped be passed in interchange?"

Mr. J. N. Barr answered this in the affirmative. Mr. J. W. Luttrell supported this opinion. Spliced hose on the Illinois Central, at the rate of about 1,200 pieces per year, was thus repaired at about 14 cents each, and when tested at 200 lbs. pressure the practice was perfectly safe. Mr. Garstang repaired enough hose in this way to save between $300 and $400 per month and confirmed the opinion as to its safety. Mr. W. S. Morris dissented. He had found difficulty due to poor judgment in selecting hose to be spliced and did not approve of the practice, but the general opinion was favorable.

No. 5. "Fastening of ladders, hand holds, brake wheels and brake shaft brackets on freight cars and the inspection of the same, from the standpoint of greater safety to trainmen."

Mr. E. D. Bronner recommended improvements in these details which were important to the safety of trainmen and should be provided for in the rules. Lag screws were dangerous from the liability of rusting and pulling out. Bolts were preferred. Mr. Ball (Lake Shore) recommended securing all ladders with one-half inch bolts. Mr. John Hodge (A. T. & S. F.) had abandoned lag screws in favor of bolts, considering the latter much safer than the former.

COMMITTEE REPORTS.

Supervision of Standards and Recommended Practice of the Association.

This report was read by abstract by the secretary.

On motion recommendation No. 1 was adopted; recommen-

dation No. 2 was submitted to letter ballot; recommendations Nos. 3 and 5 were adopted by the association; recommendation No. 4 was submitted to letter ballot; recommehdation No. 6 was adopted by the association. The five subjects mentioned at the close of the report were referred to the committee on subjects.

Triple Valves.

This report was presented verbally by the chairman, Mr. Rhodes, who stated that the test rack had been transferred from Altoona, Pa., to the laboratory of Purdue University and that no triple valves had been submitted for testing during the year. In response to questions by Mr. Barr as to why tests had not been made on the triple valve of the New York Air Brake Co., Mr. Rhodes offered the following explanation and suggestions:

At the last annual convention the following motion was offered by Mr. Mitchell: "I therefore make a motion that the standing committee on triple valve tests this year obtain triple valves from the manufacturers and make tests of them and report the results of its tests to this convention next year, giving specific names and referring to catalogue numbers." The motion was adopted, and the committee put itself in communication with the manufacturers of the New York air brake and endeavored to obtain triple valves from them for test. The president of the New York Air Brake Company wrote back to the chairman of the triple valve committee, saying that they would not furnish any triples for test. The reasons given were two, the principal reason being that owing to an opinion given by the late Mr. Massey, in 1898, following a conversation with the chairman of the committee, they objected to one of the requirements in test No. 2. The requirement reads as follows: "The final maximum pressure in this test must not be less than 15 per cent. nor more than 20 per cent. above the pressure given by the same brake in full service application." Mr. Massey, in a communication to me, told me that the New York air brake would not meet that requirement, and he wished the committee to consider a modification of these rules. He acknowledged that it was a good feature in a triple valve, but did not consider it was a vital or essential feature, and wished the committee to change it.

On that score the New York Air Brake Company objected to submitting their triples for test. They make the further argument that they have a large number of triples in use, but that the present composition of the committee on triple valve tests is such that no member of the committee has had experience in the use of their triples, and that they did not think their triples would get the attention or the care that they would if some of the members knew more about the advantages of this triple valve. I thought that both these points were legitimate objections, and are points that this association should give some attention to. The recommendations for the tests were made in 1893, when we were pretty fresh from a large number of practical road tests, both at Burlington and subsequently on the New York Central Road, and it would look to me to be quite reasonable that if there is any number of interests involved which would like to have these rules gone over and reinvestigated, this association should consent to that and perhaps recommend it.

It is true that at the time this matter was brought up that the committee then had no experience with the present New York triple, and I see no objection at all (I think it is rather a desirable thing) that there should be one or two members on the committee who have had experience with and know the service given by the New York triple. There are an abundance of them in service now.

Mr. Barr then said: "In accordance with the suggestion of Mr. Rhodes, I would move that there be added to this present committee two members who are familiar with the practical working of the New York air brake in actual service and in considerable quantities."

This motion was voted down.

SECOND SESSION.

Triple Valves.

In concluding the action on the report of the committee on tests of triple valves Mr. Barr moved: "That the committee on tests of triple valves be instructed to carefully consider the present recommended practice, with a view of determining whether any modification of the same is allowable; that they obtain sets of triple valves and make such tests of them, both on the rack and on trains, as may be necessary to give this association full information as to the construction, and that they be authorized by and with the consent of the executive committee to make the necessary expenditures from the funds of the association, the same not to exceed five thousand dollars."

The motion was passed after considerable discussion with regard to authorizing the committee to invite the air brake companies interested in the tests to assist. It was the opinion of the convention that the committee needed no instruction in this regard but that every available source of information would be utilized in order to render the reports perfectly fair to all concerned.

Interchange Rules.

The report of the arbitration committee was approved by the association.

It was then remarked that on account of recent changes in the rules the number of cases brought before the arbitration committee was greatly reduced, which was considered as an indication that the rules were now working well and that few changes were necessary. Three of the railway clubs had indicated their desire that the rules should not be changed at all. The rules were considered separately and owing to some lengthy discussions over details, the time given to the rules was three hours. The suggestions of the arbitration committee were adopted in nearly every case and there were no important changes made that were not brought forward by that committee. The question of whether the use of spliced hose should be provided for in the rules brought out considerable discussion, in which it was shown that it was not in accordance with the principles of the association for one road to dictate to another as to the safety of certain practices under dissimilar conditions. Mr. Barr thought that the roads with comparatively level profiles might use spliced hose without bad results, while perhaps that could not be said of mountainous roads, and he thought that it was not necessary to take any official action. This opinion prevailed and roads are free to refuse spliced hose if they do not consider it safe. The question was laid on the table. The prices allowed for M. C. B. couplers and parts thereof were referred back to the committee for further investigation. The entire action on the rules was practically the acceptance of the recommendations of the committee.

Passenger Rules.

A special committee on the revision of these rules reported a recommendation to permit the use of the M. C. B. defect card as an authority to make a bill for the Pintsch gas in the reservoirs of cars offered in interchange. This was referred to a committee for report next year and a recommendation providing for a committee to revise these rules for report next year was adopted. The present passenger rules were then adopted for the year as they stand.

Additional Compensation for Car Repairs West of the 105th Meridian.

This subject caused a spirited discussion last year, and the arguments in the case were summed up on page 373 of our November, 1898, issue. The committee this year did not favor an allowance for the benefit of the western roads and Mr. McConnell did not sign the report. He explained his reasons in the convention, repeating substantially the arguments of last year. He was supported by Mr. Hickey, the remarks of both gentlemen being a protest against the recommendation of the committee, but when put to vote the report was accepted, ordered printed and the committee discharged. This disposed of the question and no allowance will be made unless the subject comes up again.

Wheel and Track Gages.

Mr. Barr presented a verbal report, stating that he had conferred with the American Railway Association and that the matter was considered as a "dead letter" and would not require any important change in practice. The association referred to intended to make tests with a 50-car train on the Muskingham Valley Railroad, which were expected to develop interesting information.

Brake Shoe Tests.

The report of the committee was read and the committee continued, after which the session adjourned.

THIRD SESSION.

Square Bolt Heads and Nuts.

The report of this committee was presented in abstract by Mr. Haskell, who explained the co-operation between the committee and several manufacturers of bolts. There was no standard among the makers and the claim that heads made to dimensions other than the present Association standard had an advantage in strength over those thus made was sustained by tests conducted by the committee. The continuance of the work was suggested by the committee and further co-operation with the American Society of Mechanical Engineers, the Master Mechanics' Association and the manufacturers, looking to the selection of a joint standard. The report concluded with recommendations in regard to changes in the standard which would make the heads in accordance with the Sellers standard. These heads, while smaller, were stronger and were cheaper to make than the larger M. C. B. heads, as well as stronger. Mr. Delano moved that the American Society of Civil Engineers and the American Society of Mechanical Engineers be asked to co-operate in the adoption of this standard. This motion was passed, whereupon Mr. Barr moved that the Sellers standard should be adopted as recommended practice. This would make the width of the head of square bolts 1½ times the diameter of the bolt, while the thickness of the head is one-half the width of one side of the head. This motion prevailed and the same subject is before the Master Mechanics' Association.

Interchange Rules.

The prices for couplers and parts of couplers was taken up again, the committee recommendation being that the prices of malleable parts other than the shank should be 3½ cents per pound and similar parts of cast steel should be 4½ cents, while the other prices on couplers should remain as recommended by the committee on prices, $4.50 for coupler shanks and $7.50 for complete couplers. This was voted upon and passed, after which the interchange rules, as recommended, were adopted as a whole.

Joint Meeting of M. C. B. and M. M. Associations.

This subject was brought up for decision on the recommendation offered in the first session. After discussion the plan was approved by the association, as already printed, except that it was changed so that the M. C. B. Association would meet on the first three days of the convention week, with the hope that the M. M. Association would use the other three days. Mr. Waitt moved to authorize the executive committee to arrange the next convention on this basis.

Mr. McConnell presented complimentary resolutions concerning Mr. Cloud's excellent work as secretary, expressing the regret of the association that he could not be a candidate for re-election because of business reasons. They were carried unanimously, and Mr. Cloud made a brief reply expressing his appreciation.

COMMITTEE REPORTS.

M. C. B. Couplers.

This was the most important of the reports and an admirable piece of work. Its objects were to define the contours more fully when new, to define them more fully when worn and to propose specifications for couplers. Mr. Barr moved a vote of appreciation of the excellent work of the committee. The recommendations were taken up separately.

(A) That concerning the increase of the length of the guard arm was amended to complete the curve at the end of the guard arm beyond the point defined by the committee and was passed. The change will be submitted to letter ballot.

(B) The vertical dimension of the knuckle was recommended for increase to 9 inches. Mr. Rhodes directed attention to the desirability of reducing the width of the opening in the knuckle for the use of links of link and pin couplers, for the purpose of increasing the strength of the knuckle. Mr. Atterbury stated for the committee that the present width of opening was considered necessary. This recommendation was submitted to letter ballot.

(C) The vertical dimension of the end of the guard arm to be placed at 7½ inches as a minimum was also submitted to letter ballot.

(D) The same action prevailed as to the use of the twist gage for new couplers except that this was presented for recommended practice instead of as a standard, as in the previous cases.

(E) It was recommended that the horizontal plane containing the axis of the shank of the coupler be made to bisect the vertical dimension of the knuckle and the end of the guard arm. This was referred for adoption as a standard.

(F) The association endorsed the recommendation to the effect that "the gage for new knuckles be used on all knuckles purchased separately for renewals."

(G) It was recommended that the vertical height of the stop shoulder or horn of couplers be not less than three and one-half inches, and that the horn be arranged to touch the striking plate before the back of the head of the coupler strikes the ends of the draft timbers. This was referred to letter ballot as a standard.

The second general division of the report was directed toward more complete definition of the contour lines when worn. Gages were submitted for this purpose and they were referred to letter ballot as recommended practice. The secretary was authorized to have gages made by a reputable manufacturer and submitted for approval to the association.

The third general division contained specifications for couplers which will be found in abstract in this issue. These were adopted entire as recommended practice. It was thought advisable to test them in service before being adopted as standard.

The question of establishing the dimensions of the shank of the coupler was referred back to the present committee for further report. The consideration of the dimensions of the shank was referred to the committee for report, with recommendations, next year, and the suggestion that the back corners of the yoke in the pocket attachment be changed from a radius of ¼ inch to ⅝ inch, was adopted, while the remaining recommendation to provide play at the shank of the coupler in the carry iron of not less than ½ inch on each side was submitted to letter ballot as a standard.

Committee to Test Couplers.

Mr. Waitt then moved "that the association appoint a committee on coupler tests, to consist of not less than five members, to whom shall be submitted from time to time the testing of couplers, the committee to certify to the association those couplers that had satisfactorily passed the requirements of the standards of the association and the recommended tests. Furthermore, that this committee be authorized to arrange for construction of standard machinery for testing couplers, the same to be paid for by the association."

This important motion was thoroughly discussed and Mr. Waitt made the following remarks: "I think this subject of couplers, as well as that of brake shoes and triple valves, is of enough importance to warrant a standing committee, and having such a standing committee we should furnish them with the necessary authority and facilities for carrying out their work so that we may have a permanent benefit from it. The railroads of the country want to know on the subject of couplers what can be safely used. The tendency is to introduce devices which are cheap, and we are likely to establish quite a number of additional requirements in connection with the standard coupler, and we are likely to introduce this recommended practice for tests and specifications. It is not for many of the railroad companies represented in the association to carry on and make investigations and tests in the same way that the larger companies can, and we want to distribute the benefit of this association to all roads represented. By appointing this committee and having them make tests of couplers submitted to them, we can ask the manufacturers of couplers if they have had their coupler tested and passed. We shall be informed of those which have passed and of those which

have not passed, and we would be justified in refusing to use couplers that have not passed the tests. In that way the number of different couplers will be reduced."

The effect of this action will be to permit of weeding out poor couplers by depriving them of the sanction of the association. The discussion was closed by ordering that the standing committee on couplers should suggest a method of marking couplers to show the length of service in a way similar to that employed on air brake hose.

Air Brake Appliances.

Mr. Rhodes considered the recommendations of the committee important and suggested taking them up for letter ballot as recommended practice. The first six were ordered submitted. Mr. Rhodes then moved the appointment of a committee to confer with the air brake companies with regard to a further recommendation for the adoption of the recommended practice. The present committee was continued for this purpose.

Wheels and Axles.—Specifications for 60,000, 80,000 and 100,000-Pound Cars.

The committee submitted specifications for 33-inch cast-iron wheels, which were ordered submitted to letter ballot for recommended practice.

The axle for 38,000-pound cars recommended by the committee was criticised by Mr. Sanderson because, when the journals are worn, their length being 1 inch greater than the journals of the 80,000-pound axles, they could not be utilized in cars of lighter capacity. Mr. Higgins did not believe it wise to take chances in regard to strength and to sacrifice safety and satisfactory operation for the purpose of saving money in repairs, and this view prevailed. The design was ordered referred to letter ballot for recommended practice. The specifications for steel and iron axles were disposed of in the same way and the association voted to use numbers to designate the different standard axles instead of the dimensions of the journals, as is now generally the case.

Uniform Sections for Car Sills.

The purpose of the report was to show that by standardizing the sizes of sills better lumber and more prompt delivery could be secured from mills and car building companies. Mr. Barr suggested that the work should be extended to include siding and roofing, and it was stated that the committee on subjects for the next convention had provided for this. The recommendations of the committee were ordered submitted to letter ballot as a standard.

Height of Couplers.

This report was received and the committee discharged, as no other action was necessary.

Committee on Subjects.

The report of this committee was as follows: Standard center plates; Draft gear, Standard spread for side bearings; Air brake hose specifications; Uniform sections of car siding and car flooring; Design of journal box, box lid, bearing and wedge for cars of 100,000 pounds' capacity; Dead blocks; Safety chains.

The election of officers resulted as follows: President, C. A. Schroyer; 1st Vice-President, J. T. Chamberlain; 2nd Vice-President, W. J. Robertson; 3rd Vice-President, J. J. Hennessey; Treasurer, G. W. Demorest; Executive Committee, S. P. Bush, A. E. Mitchell, Wm. Garstang; Secretary, J. W. Taylor.

For places for holding the next convention, Detroit, Saratoga, Cleveland and Alexandria Bay were suggested and the matter was left with the executive committee.

The convention adjourned at 12.30 P. M., June 16.

Brief and active topical discussions, with a short time allowance for each subject, are exceedingly valuable in the deliberations of a technical association. The list of subjects is not always completed and the action of the M. C. B. Association this year in ordering the introductory remarks for those which were omitted in the meetings to be printed in the proceedings is to be commended in order that the preparations for their presentation shall not be lost.

THIRTY-SECOND ANNUAL CONVENTION.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.

The convention opened with prayer by Chaplain Charles S. Walkley, of the United States military post at Fortress Monroe. The opening address was delivered by the Hon. Joseph Bryan, President of the Richmond Locomotive Works. After referring to the historical interest of Old Point Comfort, the vital influence of transportation in improving the commercial and social condition of the country was commented upon, particularly in unifying the people of the United States. The speaker gave an account of the purpose and plan of the International Railway Congress. The importance of railroad transportation rendered the deliberations of this organization of exceedingly great value, and it was hoped that this country would be represented by a larger number of motive power men in the congress in Paris next year than was the case in London in 1895. The early history of the locomotive was presented in an interesting way, which led up to the recent recognition of the superiority of American designs, as indicated by orders received from foreign governments. An English view of the effect of this was a tendency toward the revision of practice there on a common sense basis, which would permit builders to have the advantage of uniformity. The address was interesting and well delivered.

Mr. W. S. Morris, Superintendent of Motive Power of the Chesapeake & Ohio, replied briefly with comments upon the remarkable advances of the past few years in the development of powerful locomotives which made the use of standards very difficult. Something should be done to eliminate unnecessary novelties in designs, and closer relations between the master mechanics and the locomotive builders with this object in view were desirable.

Mr. Quayle then read his presidential address. The condition of the association as to membership and finances was very satisfactory. The address was thoughtful, dignified and suggestive. It contained allusions to the war and the part played by the motive power men. The fact that they contributed in getting Admiral Dewey's ammunition across the continent and to Hong Kong three days before his departure for the historical victory at Manilla should be a source of encouragement in days of drudgery. The marked advances during the year in increasing the power of locomotives received thoughtful consideration with regard to the savings thus made possible. By increasing train loads from 1,500 to 2,100 tons on grades of 6-10 to 7-10 per cent. not less than one-half the cost of the heavier engines required to do this work ought to be saved each year. The saving was to be had in the better use of fuel and in the reduction in wages. The compound locomotive had gained many friends during the year and was now no longer "in the balance." Shop arrangement needed more attention, particularly with reference to the possibilities of extension to meet increased demands. The address was admirable and we shall refer to it again.

The report of the secretary showed the association to be in a very satisfactory condition, the membership now being 653, the greatest in its history. There were no funds in the hands of the secretary, the expenditures being equal to the receipts for the year. The treasurer reported the receipts and expenditures and stated that the balance on hand was $3,116.96.

The time for holding the next convention was discussed on the lines of the action taken by the Master Car Builders' Association. The matter was referred to the executive committee with power to act in conjunction with the executive committee of the other association. It is therefore assured that the two conventions will be held in one week next year.

Messrs. R. A. Smart, S. L. Kneass and Clement F. Street were elected to associate membership.

The association passed a resolution expressing the appreciation of the work of the Master Blacksmiths' Association and pledging co-operation in their efforts toward improvement. The same action was taken with reference to the Master Car Painters' Association.

Topical Discussions.

Subject No. 9.—"The comparative efficiency and economy of metal flexible joints vs. rubber hose for steam connections," was introduced by Mr. A. W. Gibbs, who stated that the oil thrown by driving wheels had seriously affected the usefulness and life of hose connections between engines and tenders. Metallic tubing with flexible joints were successful in overcoming this difficulty. The cost was greater but the benefits in avoiding failures were sufficiently important to warrant it. Mr. Frank Slater supported Mr. Gibbs' opinion and the only trouble he had experienced from wear had been overcome by locating the conduits nearly in line with the center of the draw connection. Mr. Manchester had used these connections with good results in carrying high-pressure steam from locomotives to baggage cars for electric lighting engines. About eight hose connections were required per year, while the pipe conduits were guaranteed for three years' service. Mr. Johnson reported adversely. Wear and condensation were found to be a serious disadvantage of the pipe connection. The general opinion was decidedly favorable to metallic connections similar in principle to the form shown on page 376 of our issue of November, 1898.

No. 1.—"To what extent and with what success have the recommendations of the committee on exhaust nozzles and steam passages been adopted?" Mr. A. L. Humphrey had asked 30 members of the association for their opinion on the subject. The practice was becoming almost universal. The draft appliances were generally considered very important in influencing the economy of operation of locomotives in its effect of reducing back pressure and improving the draft. Mr. Quereau, in examining this question, had found differences of opinion. His own experience was favorable, no great gain in economy had been attained, but the use of larger nozzles was possible. Mr. Robert Miller spoke warmly in support of the Master Mechanics' arrangement of front ends.

No. 2.—"Has not the time arrived when air brake instructors can accomplish more by instructing those who maintain brakes how to maintain them, than to instruct those who use them how to use them?" Mr. R. W. Bailey presented the subject. Both those who use and those who maintain the brakes should be instructed. Mr. Deems believed it dangerous to "let up" on the care now given to the instruction of trainmen and enginemen. A member believed it necessary to improve in the character of men who maintain the air brakes or to take their work into the shops. Mr. Huntley (C. & O. Ry.), as an air brake inspector, had found it necessary to devote more attention to the maintenance men, who were always ready to receive information. Mr. Conger had found trains in which 60 per cent. of the brakes were defective, which pointed to the absolute necessity of better maintenance and the inspectors should be instructed more carefully. They were worthy of it and capable of improvement. Mr. Small (Southern Pacific) desired to see definite action on this question. He would have traveling engineers take a larger part of the instruction of the enginemen, which would allow the air brake inspectors time to devote to the repair men.

No. 4.—"When double headers are used on passenger or freight trains, is it good practice to cut out the brakes on the head engine, and does this comply with the requirements of the law?" Mr. T. R. Browne believed that it was advisable to give both engineers the power to handle the brakes. Mr. Quereau would cut out the driving wheel brakes of the forward engine and that engine should control the brakes. This discussion developed the fact that what was safe in one part of the country was not necessarily so in other parts, and it was considered to be ill advised that the association should put itself on record in such a matter.

COMMITTEE REPORTS.

A Research Laboratory Under the Control of the Association.

Mr. Henderson presented the report in abstract. Mr. Sanderson did not agree with the report as to the policy of placing the large number of special subjects requiring the work of specialists in the hands of a general laboratory. The members themselves should do this work because of the advantage to be derived from the conduct of investigations. They should themselves be specialists. Mr. Delano agreed with Mr. Sanderson and doubted the advisability of centralization of research work.

Mr. Barr thought that a research laboratory would be established in the future. It was perhaps too soon to establish it now and it was too large a subject to discuss at this time.

Mr. Henderson desired to have the subject kept before the association by the adoption of the resolutions reported by the committee.

These resolutions were passed and the subject is placed in the hands of the executive committee. Nothing was settled by the discussion and whether or not such a laboratory was needed was not decided. The prevailing opinion in the brief discussion seemed to be adverse to the whole plan.

SECOND SESSION.

At the reassembling of the association Captain Robley D. Evans, U. S. N., gave a characteristic address which stirred the audience to demonstration and gave each auditor additional reasons for pride in our navy, its officers and equipment.

COMMITTEE REPORTS.

Best Methods of Preventing Trouble in Boilers from Water Impurities.

Mr. A. E. Manchester presented the report, which was an exhaustive treatment of the subject. Mr. Small related his experience with the method of treating water in tenders by the use of soda ash, which, owing to the character of the water, was not successful. Excessive blowing down was necessary and foaming occurred. For his conditions the pumping station method was better; the cost of a station did not exceed $1,500 and was found economical. The process was efficient and in every way desirable. Mr. Delano referred to the heating of feed water by exhaust steam to precipitate the lime salts. He did not, of course, approve of evaporation plants, where live steam was used, but thought that waste steam now thrown away at shops might be utilized for this purpose. Prof. Hibbard explained the importance of preventing oil from passing into boilers when feed water is heated by exhaust steam. Mr. Barr directed attention to the importance of closely watching the work of the men in charge of the boiler washing, without which success could not be secured. Mr. McKenzie spoke of the use of the blow-off cock with waters that were not treated. The blowing off should be done immediately after the completion of a run. The cocks should be opened long enough to blow down about 1½ gages of water. The feeding of oil into the boiler was meeting with success. Mr. McIntosh believed that the blow-off cocks should be used while the engine was running, because of the assistance derived from the rapid circulation of the water at such times the sediment could be removed in greater quantities. Perforated pipes had not given success in his experience. Mr. McKenzie explained that the best effect of perforated pipes was had when the number of holes was not quite large enough to give a perfectly free exit to the blow-off cock. The effect of this was to distribute the action of the pipe over a large space.

Relative Merits of Cast-Iron and Steel-Tired Wheels.

This report was introduced by Mr. Barr, who deplored the small number of replies to the questions of the committee, especially in view of the fact that many roads now possessed the necessary information to permit of comparing the service and security of wheels of both classes. The question was raised

as to whether the necessity for using steel-tired wheels for engine trucks did not constitute a charge that cast-iron wheels were less safe than those with steel tires. Mr. Barr replied, in effect, that cast-iron wheels were strong enough for all service except that of guiding the front ends of present heavy locomotives. Mr. Small raised the question of the effects of increased capacities of cars and the continuous action of brakes on mountain grades.

Mr. Hickey moved that the committee should be continued to report upon wheels under engine trucks and tenders and to consider the different weights of wheels to be used for these purposes. It was arranged to select five members for this committee, two being selected from roads having heavy grades.

TOPICAL DISCUSSIONS.

No. 10.—"Can the ordinary Marine Salinometer be used to advantage in Districts where Alkali Water has to be used, in order to avoid excessive Concentration and Damage to the Fire Box?"

Mr. Morris explained the use of this device for ascertaining the specific gravity of boiler water. It would not give information other than the specific gravity and in many cases the amounts of the destructive solids in boilers were too small to be measured in this way.

No. 5.—"Is the use of Fusible or Soft Plugs in the Crown Sheets of Engines advisable?"

Mr. McIntosh was of the opinion that these plugs were so dilatory in action and had so little effect on the fire as to be inefficient for the purpose intended. They were considered very unreliable. It was moved that it was the sense of the association that the use of fusible plugs in crown sheets was not conducive to the prevention of overheating of crown sheets. Carried.

No. 6.—"What Advantages are gained by the use of Piston Rods extended through the front Cylinder Heads?"

Mr. Soule referred to this practice as a result of the use of larger cylinders. There was no unanimity of opinion among railroad men or locomotive builders on this practice and the limiting size when it became necessary was not determined. Many believe that the extended piston rod would be necessary in the future, but the details needed to be studied. Mr. Quereau believed that the extended piston rod was advantageous and that with good packing and good lubrication the practice should be made entirely successful. Messrs. Slater and Gaines did not see the necessity for these rods because their experience had shown that cylinders did not wear on the bottom but on the top, and it was not clear why the piston should be held up. Mr. Sague expressed the opinion that extended piston rods should be used on cylinders of 19 inches and more in diameter, with a view of providing an easily renewable bearing for the weight of the piston in order to avoid the expense of frequently boring out cylinders. Mr. Delano referred to the increase of the bearing surface of the piston in the Class H 5 and H 6 engines of the Pennsylvania, illustrated in the American Engineer, June, 1899, page 182, as a good method for providing additional bearing surface without the use of extended rods.

Resolutions were passed expressing the regret of the association that Mr. Cloud was obliged to decline re-election as secretary on account of going abroad, and voicing the sentiment that he had the good wishes of the association in his absence from this country. Mr. Cloud replied briefly and gracefully.

COMMITTEE REPORTS.

Advantages of the Ton-Mile Basis for Motive Power Statistics.

Mr. Quereau offered a resolution as follows: "Resolved, That it is the opinion of the association that the ton-mile basis for motive power statistics is the most practical method of comparison of results and that it encourages economical methods of operation and that it is desirable that the heads of motive power departments should urge its adoption by their managements." The committee was continued for further investigation during the year.

The discussion did not bring out more information than was given by the committee, but it was clearly the opinion that great care should be given to the methods of comparing the service of men in order to secure fair conditions. The importance of the subject appeared to be thoroughly appreciated, as also was the fact that the motive power department was merely a part of the road and not an organization with interests of its own, as it was too often considered formerly.

CLOSING SESSION.

This session opened with resolutions providing for a committee to report each year upon how generally the standards of the association are used by the members and one to report next year upon "How the association can improve its usefulness." The latter committee was appointed in response to a uggestion contained in the address of the President.

COMMITTEE REPORTS.

Best Methods of Applying Stay Bolts to Locomotive Boilers.

Mr. Higgins offered an additional reason for drilling instead of punching tell-tale holes in stay bolts. Experiments on a vibration machine had shown drilling to be far superior to punching in its influence on the strength of the stay bolts. Mr. Soule stated that the practice of the Baldwin Locomotive Works had been changed from punching tell-tale holes to drilling them, but the holes were drilled before putting the stay bolts in place. Mr. Slater approved of drilling stay bolts in the shop, because of the difficulty in getting the holes central with the bolts when the work was done after the bolts were placed in the boiler and riveted up. Mr. McConnell had drilled stay bolts in the shop for several years. Mr. Gillis spoke favorably of the use of dies instead of lead screws for threading stay bolts. Mr. Soule differed with Mr. Gillis as to the accuracy of dies for thread cutting. He preferred positively the lead screw because the correctness of thread depended largely upon the accuracy of the size of the rough stock. Mr. Gillis replied by quoting experience supporting his previous statement. Mr. T. R. Brown had carefully investigated the whole question and found it advisable to use an accurate lead screw for making the hobs and did not use the lead screw directly. By daily comparisons with a gage the threads were kept in correct condition. He had investigated the steels for taps and by ascertaining the amount of change in hardening this effect could be provided for. He made his own taps and could make more accurate ones than he could buy. Mr. Atkinson placed himself on record as disapproving the use of tell-tale holes because of their weakening effect at the failure point of the stay bolts. Mr. Gaines believed that the holes actually strengthened the bolts.

Flanged Tires on Driving Wheels.

Mr. McConnell reported the use of all flanged tires on a number of important roads. On the Union Pacific no plain tires have been put on consolidation, ten-wheel or switch engines for several years. On consolidation engines the tires of the two middle pairs of drivers were set 3-16 inches closer together than the others. With this practice the wear of the flanges of the other wheels was less than before. The Baldwin and Brooks Works used flanged tires on all engines of these types when not otherwise ordered, but the other builders had not adopted the practice to that extent. It was important to save the expense of carrying two kinds of tires in stock. The general opinion was decidedly favorable to the use of flanges on all tires, with plenty of allowance for lateral motion of the axles between the boxes, but there was not by any means an undivided opinion on the subject. Mr. Quereau moved the continuance of the committee with instructions to secure information with regard to the effects of this proposition on the track because of the danger of getting into trouble with excessive play on account of frog points.

Best Form of Fire Box to Prevent Leaking.

There was no report from this committee and the committee was continued to report next year.

Use of Nickel Steel in Locomotive Construction.

The report was presented by Mr. L. R. Pomeroy by request of the association.

Mr. H. F. J. Porter was invited to speak on the subject. He was interested to see that nickel steel should not receive a "black eye," such as steel in general had experienced in the early days because the metal was not understood. The heat treatment was most important and this was not generally understood. The report was ordered printed and the discussion postponed.

Square Head Bolts and Nuts and Standard Pipe Fittings.

Mr. Quereau presented the report and showed that it was probably not to be difficult to secure uniformity in pipe fittings. The report also interested the Master Car Builders' Association as has already been stated. Mr. W. H. Lewis moved the endorsement of the recommendation of the committee, which was to the effect that the association should adopt the Briggs standard as determined by the Pratt & Whitney Company's gages, as the standard of the association for wrought-iron pipe and couplings. This was carried. The report was really a joint one with the M. C. B. committee, but the work was divided, the M. C. B. Association considering the part concerning bolt heads, while the M. M. Association treated the pipe subject, but both committees joined in signing both reports.

Topical Discussions.

Subject No. 8.—"What can be done to thoroughly relieve the Vacuum in a Low-Pressure Cylinder of a Compound Locomotive when Drifting?" Opened by Mr. Sinclair.

Relief valves had been thoroughly tried and found unsatisfactory, chiefly owing to leakage. By-pass arrangements were efficient for the purpose and would probably be used quite generally in the future. Mr. Mellin reported favorable results with by-pass valves. Mr. Sanderson recommended the use of the throttle to pass a little steam into the cylinders when not working. Mr. W. S. Morris supported the favorable opinion of by-pass valves.

No. 11.—"Is it advisable or not to use Bars in Exhaust Nozzles?"

The association passed a vote that its opinion did not favor the use of bridges or bars in exhaust nozzles.

Subject No. 12.—"Is there sufficient Prospective Economy to be derived from heating the Feed Water for Locomotives, and how can it be most reliably fed to Boilers?"

Mr. Garstang appreciated the value of heating feed water, but he did not see how it could be accomplished in any other way than to use the exhaust of air pumps and the waste steam from blowing off. The prevailing opinion was that feed water heating was not worth the trouble involved, but no one spoke on the subject in the light of recent experience, and the discussion can not be considered as conclusive or satisfactory.

Closing Business.

No recommendations as to the place of holding the next meeting were made.

The election of officers resulted as follows: President, J. H. McConnell; First Vice-President, W. S. Morris; Second Vice-President, A. M. Waitt; Third Vice-President, J. N. Barr; Treasurer, G. W. West; Secretary, J. W. Taylor.

The convention adjourned at 12.45 P. M., June 21.

The heating surfaces of boilers tested under the revised code for boiler trials, recently reported to the American Society of Mechanical Engineers, will be measured by the side of the tubes next to the fire. This will cause additional calculation, but it is the correct way to measure heating surface.

THE PRATT & WHITNEY COMPANY.

By M. N. Forney.

The striking object in approaching Hartford is the State Capitol building, which stands on an elevation in a park alongside the railroad. Not having seen all the other State capitol buildings in the country, a sweeping comparison with them would be unwise, but it is safe to say that this one is the most beautiful of the dozen which the visitor has seen. A remarkable fact about it is that it was built at a cost within the original estimates, and was completed within a reasonable time after its construction was commenced.

To reach the Pratt-Whitney works from this railroad station involves a walk through the grounds in which the capitol stands. It is well worth visiting and a traveler in New England would be repaid to stop over from one train to another to look at it.

Like many other similar establishments, that of the Pratt & Whitney Company has grown very much within the recollection of the writer. Their product is confined to the lighter class of machine tools and embraces a great variety. This article would assume the character of a catalogue if the different kinds which are made here were merely enumerated, so the specifications must be very general. Besides the ordinary tools and machines, such as lathes, drill presses, boring machines, gear-cutters, they make a great variety of screw machines. Of these it may be said, in the language of Herbert Spencer, that their evolution has been from the homogeneous to the heterogeneous, and instead of the comparatively simple appliances for making bolts which were employed forty or fifty years ago, in which all the operations were either performed or directed "by hand," we now have a complicated mechanism which acts automatically and performs the greatest variety of operations without any other attention than that of supplying the material required, and then start and stop the machine. We old fellows, who were apprentices half a century ago, can remember that one of the first "jobs" on which we were put at work was the centering of bolts, which were forged by hand. This was done with a center-punch, and the bolt was then revolved on two centers, and a piece of chalk was held so as just to touch the most prominent part of the bolt as it revolved. If this chalk marked all round, it indicated that the bolt was centered true, but if it was not, the chalk would mark on one side only, and would show which way the center should be moved. When the position of the centers was then established, the next process was to drill into each end of the bolt and then countersink the drill holes. The bolts were then put into a lathe and the ends cut off to the proper length and the heads faced on the tops and bottoms. The shanks of the bolts were afterwards turned, and they were sent to a "chasing lathe" to have the screws cut on them. The heads being forged by hand, were often sadly awry, and these were planed off true in a small crank planer, one side at a time, the bolt being held in centers and turned a quarter or a sixth of a revolution after each side was planed. The heads were then filed smooth and polished on a buffing wheel.

In a modern screw machine a long, horizontal or square bar of iron, according to the shape of the head, is fed into the machine through the spindle. Sufficient metal is cut away to form the shanks of the bolts, the screw is cut, the heads trued up and the bolt cut off the right length by a series of tools in a turret, which are successively brought into operation automatically. The Pratt & Whitney Co. make a great variety of such machines for the manufacture of all kinds of bolts, studs, pins and other parts used in machine construction. These are produced with the utmost precision, and their size is so accurate that they are absolutely interchangeable. It would take an elaborate treatise to describe these machines and their work, and much mental effort would be needed to understand the treatise, the writing of which will be indefinitely postponed.

But still another step has recently been taken in screw and

bolt machinery. When bolts are made out of a solid bar, there is, of course, much waste of material, as the original bar is the size of the head of the bolt or screw, and the bar must be cut away to form the shank. The improvements made in forging bolts have been so great that the heads are now formed of such accurate sizes that no finish is required and the shanks are made with an equal degree of precision. It is evident that if such bolts can be forged at a low cost, and if they can be finished in an automatic machine, that considerable economy will result. To meet this requirement what are called "magazine" machines have been produced. In these the forged bolts are placed in a receiver, which consists of a groove of the shape of a letter ▷ , which receives the heads of the bolts. These are placed in the upper end of the groove and are taken out successively by the machine at the lower end. All the other operations are automatic, the tools being attached to a turret and are brought into operation successively at the proper time without any co-operation of the person who superintendents the working of the machine. As long as the supply of forged bolts is maintained, the machine continues to produce the finished articles. An operator will superintendent the working of a number of machines, and all he must do is to keep them supplied with the raw material in the form of forged bolts. These machines are, of course, very complex, but they do their work with wonderful accuracy and certainty, and at a cost which makes handwork an impossibility.

The Pratt & Whitney Company have made a great deal of machinery and tools for the manufacture of bicycles, but at present there is less activity in this line, owing to the failure of many establishments which were engaged in this new business, and whose appliances have been thrown upon the market.

It may seem remarkable to many of the younger generation of engineers and machinists that there could have been a time when each shop had its own system of screw-threads, and that it was rarely that a nut of any nominal size, made in one shop, would fit a bolt of the corresponding size in another. Nevertheless such a condition of things existed not so many years ago, and those of us who engaged in the propaganda of introducing the Sellers standard for screw threads often recall the struggle now with some satisfaction, knowing that the victory has been won. When action was first taken by the Master Mechanics and Master Car Builders' Associations, to adopt the Sellers standard, the Pratt & Whitney Company engaged in the manufacture of taps and dies, gauges and other tools of precision for the making of screws which would be interchangeable. Before that time there were no screws made in this country that were certain to interchange with any others. The standard gauges of the so-called U. S. screws did not agree with each other. In fact the Pratt & Whitney Company in the outset of their new enterprise found that there was no absolutely reliable standard of measurement in this country, so they started at the foundation, and procured several verified standard yards compared with the one in the Tower of London. Being sure of their ground in this respect, they next found it essential to make a dividing machine by which the yard could be divided into any number of parts, inches and fractions of an inch—with sufficient precision. Afterward they had to devise many kinds of tools and processes for the manufacture of taps and dies, so as to secure interchangeability of the screws made with them. A large amount of money was invested in the plant for this work, and it now forms an important branch of their business. At first one of the difficulties encountered was that the screws of nominal sizes in general use were in reality over size. That is a ⅞-inch screw was often 29/32 in diameter, and a great many taps and dies were ordered oversize. Of course, as long as this practice prevailed interchangeability of screws was impossible. Gradually the public has been educated in this respect, and now the Pratt & Whitney Company say that only about 10 per cent. of the taps and dies, which they supply, are over-size, and the number of them which are furnished is steadily diminishing. Being a reformer is not often a very happy existence, but it is a satisfaction to some of us who engaged in the crusade for standard screw-threads years ago to know that we won the battle.

Gauges of various kinds and measuring machines also form an important part of the product of this company. Another treatise might be written to describe what is done in this department, but that, too, is indefinitely postponed.

An interesting place is a large storehouse for the finished products of this establishment. In order to produce lathes, drill presses and many other tools and machines, at the lowest possible cost, it is essential that a large number should be made at one time. If this is done, unless ordered ahead of their production, some or all of them must be stored until they are wanted. Consequently this company has constructed a large storehouse near the shops, which now contains a large stock of the machines which they make—the stock on hand and that in progress amounting in value to over $1,000,000.

There is much more of interest in this establishment—sufficient to make a considerable number of articles of this kind, but the length of this one compels me to end it abruptly.

TRANSPORTATION EXHIBITS AT PARIS IN 1900.

Mr. Willard A. Smith, Director of Transportation and Civil Engineering to the United States Commission, Paris Exposition, sends us the following information with regard to the arrangements which he has made for the department:

The exhibit of Civil Engineering and Transportation in the American section at the Paris Exposition promises to be very large and thoroughly representative. Owing to the nature of the exhibits and the character of the buildings, this department will be represented in several different locations. The exhibit of the Merchant Marine will be made in the Merchant Marine Building on the banks of the Seine. The principal features will consist of a large exhibit by the American lines and models illustrative of American yachting. Permission has also been secured to install in this building models of American naval vessels, and it is intended to show all of the most important battleships, which have become famous in the recent war. In the Palace of Transportation and Civil Engineering on the Champs de Mars will be located the carriage and vehicle exhibit. In the same location, on the ground floor and partly on the gallery, there will be an exhibit of Civil Engineer ing which will consist of models, maps and photographs, illustrating the engineering features of our great cities, transportation lines, etc. One of the most important of these exhibits will be a model some 20 feet in length, of the Chicago Drainage Canal. In connection with this will be shown models of all the great variety of excavating and conveying machinery used in this most important of recent works of this kind. These models will be shown in operation, and it is believed that this will be the best exhibit of an engineering character ever made at any exposition. The railroad exhibit, consisting of cars, locomotives, railway machinery and appliances of every kind will be made in the buildings provided for this purpose at the Bois de Vicennes, where all railway exhibits made by all countries will be located. There will be at least 16 American locomotives which, on account of their magnitude, will be very attractive to foreigners. The fact that our locomotive builders are now securing business in all parts o fthe world, including even France and England, gives this exhibit peculiar importance and significance at this time. Steel cars and other recent developments in American railroading will also be properly represented. At the Bois de Vicennes will also be located the bicycle and automobile exhibits. A space of 8,600 square feet has been secured for the American Bicycle Building. A track some two miles in length running around the Lake Daumesnil in the Bois de Vincennes has been provided for showing automobiles and motor vehicles of all kinds in operation. A space of 4,300 square feet in the automobile building has been secured for American exhibitors. At Lake Daumesnil will also be shown our steam, electric and gasoline launches in operation, as well as a live exhibit of life saving service and everything of that nature.

Actual allotments of space have not yet been made in the Transportation Department, owing to the fact that it has

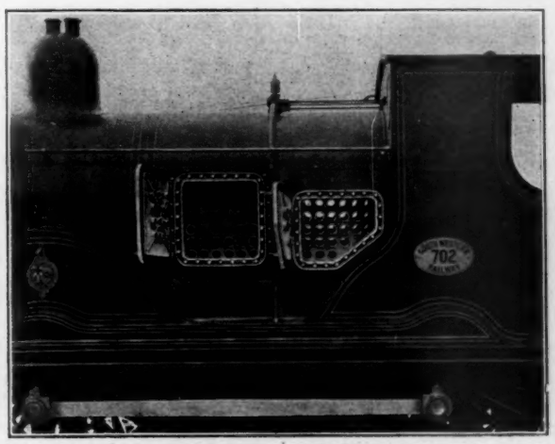
been impossible to get a definite location and information regarding the same from Paris. Commissioner-General Peck, who is now in Paris, has been extremely successful and has secured a much larger amount of space than was heretofore deemed possible. All manufacturers of any material included under the general title of Transportation and Civil Engineering should at once make their application for space if they have not already done so.

WATER TUBES IN LOCOMOTIVE FIREBOXES.

London & Southwestern Railway.

The accompanying engravings were made from photographs of what is known as the "No. 702 Class" of express locomotives on the London & Southwestern Railway which were received after our March issue containing the description of Mr. D. Drummond's practice with regard to firebox water tubes was

Locomotive with Water Tubes Across the Firebox.
London & Southwestern Railway.



Side View, Showing Ends of Tubes.

on the press. Mr. Drummond now sends these photographs and the following particulars:

Heating surface of boiler tubes	.....	1,187 sq. ft.
" " firebox tubes	.....	165 sq. ft.
" " firebox	.....	148 sq. ft.
" " total	.....	1,500 sq. ft.
Grate area	.....	24 sq. ft.

It will thus be seen that the heating surface of the firebox tubes is a little more than that of the firebox itself. The boiler pressure is 175 lbs., and Mr. Drummond writes us that these engines maintain full steam pressure when the engines are working at their maximum capacity. The views show the appearance of the firebox tubes with the cover plates open and also the exterior of the engine with the covers closed and the jackets in place.

STEEL CARS AT THE CONVENTIONS.

The Pressed Steel Car Company exhibit at the Old Point Comfort conventions consisted of six cars embracing the practice of two years ago and the latest improvements. The present state of the art was shown by a new and very large hopper car for the Lake Shore & Michigan Southern. With a capacity of 110,000 pounds of coal or coke, the weight of the empty car is but 36,600 pounds, which is about one ton lighter than the Pennsylvania cars of the same type, and of slightly greater capacity. The Lake Shore cars have an improved door operating device which is entirely protected by being under the car, the only portion projecting from the side being the squared end of the shaft and the pawls for locking it. This device is much simpler than any previous arrangement and it is powerful because of the use of a large toggle joint. This and several of the other cars were fitted with the McCord journal box and the trucks are of the diamond type of pressed steel.

The Pittsburgh, Bessemer & Lake Erie coal and ore car that was at the conventions two years ago appeared again this year, after continual service, and it is stated that it has been very severely used, although there are no evidences of deterioration. This car has the Schoen pressed steel trucks. Its capacity is 100,000 pounds of coal or ore and its weight is 34,350 pounds.

An ore car from the Monongahela Connection Railway of Laughlin & Co., which has hardly missed a day's service in 18 months, shows the ability of these cars to stand punishment. Its capacity is 100,000 pounds and its weight 28,800 pounds. Ore service is specially severe and yet the car appears to be in perfectly good condition.

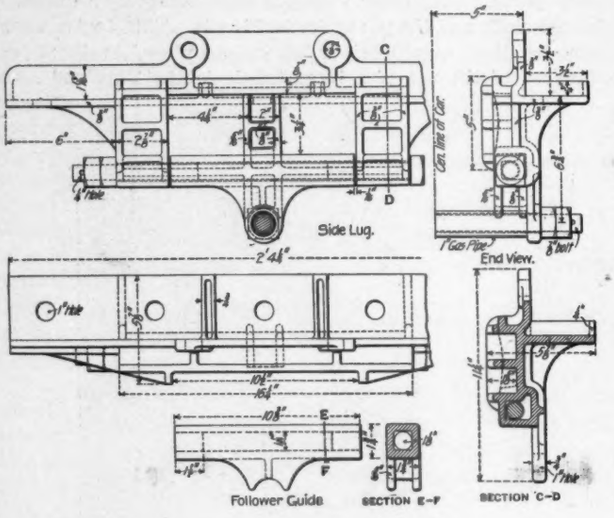
The fourth was a 100,000-pounds capacity coal car from the Pennsylvania Company. Its weight is 38,300 pounds and after 18 months' service the only signs of wear are in the absence of paint on the inside of the car and the scars of the plates, which would be expected from the abrasion of the coal. The fifth was like the one just mentioned except that its capacity was 95,000 pounds. It had been used one year. The sixth was a Union Pacific gondola of 90,000 pounds' capacity, with four drop doors at the center. This car was built for coal, ore or coke. It weighs 29,900 pounds and has Fox trucks and the Buhoup three-stem coupler. The exhibit was in the charge of Mr. A. G. Glover and it offered the best possible opportunities to examine the pressed steel car situation, as it exposed the effects of from 15 to 25 months of service.

The "Railway Master Mechanic" changed permanently to magazine form with the appearance of the June number, which is 7 by 10 inches in size and in every respect an admirable improvement. It is specially noteworthy for the typographical work and engravings, as well as the quality of the paper and the excellent taste shown throughout. Typographically it is among the best publications outside of the art magazines.

SIDE LUG FOR MILLER HOOK COUPLER.

Northern Pacific Railway.

An improved passenger draw-bar lug, as in use on the Northern Pacific, is herewith illustrated. The lug is of malleable iron, designed to replace the old cast iron lug, and have an increased strength in itself, as well as a more secure fastening to the draft timbers. The bearing surface on the draft timbers was lengthened so as to use two more vertical bolts. The part of the casting on which the followers rest was made separate in the new pattern, in order to allow the renewal of a broken



Side Lug for Passenger Couplers.
Northern Pacific Railway.

part without removal of the entire draft lug. This piece is held in position by a 1⅛-inch bolt, which passes through it, and the two ends of the draft lug, holding it longitudinally, and furnishing an excellent measure of safety in the event of breakage of the lug itself. A ⅞-inch bolt secures the two lugs transversely. The strain of the latter bolts is taken on a gas pipe spreading thimble 10 inches long. These lugs when once applied stay in place, for it is impossible to lose any part of them by breakage with this system of bolting.

POWERFUL 8-WHEEL PASSENGER LOCOMOTIVES.

Chicago & Northwestern Ry.

The selection of the type for new passenger locomotives is an interesting subject upon which there are wide differences of opinion among railroad officers and locomotive builders. The Atlantic type has strong support in the design of the new Baldwin compound for the Burlington (American Engineer, May, 1899, page 141), which will take its place among the most powerful passenger locomotives ever built.

The eight-wheel type, the simplest and cheapest to build, and probably also to maintain, is the distinctive American type, and the two recent designs of the Chicago & North Western, built by the Schenectady Locomotive Works, are specially commended, because these are to be classed with the Burlington engines in regard to power, and yet they are of the eight-wheel type. The object was to secure the maximum power carried upon the smallest possible number of wheels. This is an attempt to exhaust the possibilities of present common practice before resorting to a more complicated type. The result is to secure eight-wheel locomotives which are more powerful than many recent 10-wheel and Mogul designs, and such a sensible idea should command the attention of others who find it necessary to increase the capacity of their passenger locomotives.

In respect to steam producing capacity, the fast mail locomotives (American Engineer, June, 1898, page 188) and the heavy passenger locomotives under discussion are the most noteworthy used in their service and that there are no novelties about them is one of their chief attractions. A table of the most important dimensions of the heavier engines is appended and comparison with the fast mail design and other recent high speed engines will be instructive and suggestive.

The foregoing does not detract in the least from the credit due to designs employing a larger number of wheels. The point we desire to make is that the possible limits of the Atlantic and 10-wheel types have not yet been approached when it is seen that the capacity of the eight-wheel type may be made as great as in these cases.

Heavy Passenger Locomotives.

C. & N. W. Ry.

General Dimensions.	
Fuel	Bituminous Coal
Weight in working order	137,000 pounds
Weight on drivers	87,000 pounds
Wheel base, driving	8 feet 6 inches
Wheel base, rigid	8 feet 6 inches
Wheel base, total	24 feet 8 inches
Cylinders.	
Diam. of cylinders	19½ inches
Stroke of piston	26 inches
Horizontal thickness of piston	5½ inches
Diam. of piston rod	3¼ inches
Kind of piston packing	Dunbar
Size of steam ports	18 inches by 1⅝ inches
Size of exhaust ports	18 inches by 3 inches
Size of bridges	1⅜ inches
Valves.	
Greatest travel of slide valves	6 inches
Outside lap of slide valves	1¼ inches
Inside lap of slide valves	Clearance ⅛ inch
Lead of valves in full gear	¼ inch lead at 6-inch cut-off
Wheels, Etc.	
Diam. of driving wheels outside of tire	75 inches
Mat'l of driving wheel centers	Cast steel
Driving box material	Cast steel
Diam. and length of driving journals	9 inches dia. by 11½ inches
Diam. and length of main crank pin journals	6 inches dia. by 6 inches
Diam. and length of side rod crank pin journals	4½ inches dia. by 4 inches
Engine truck journals	6 inches dia. by 12 inches
Diam. of engine truck wheels	36 inches
Kind of engine truck wheels	Krupp steel
Boiler.	
Style	Extended wagon top
Outside diameter of first ring	64 inches
Working pressure	190 pounds
Material of barrel and outside of fire box	Carbon steel
Thickness of plates in barrel and outside of fire box,	11/16 inch, ⅝ inch, 7/16 inch, ½ inch
Fire box, length	108 3/16 inch
Fire box, width	40⅜ inches
Fire box, depth	Front 79¾ inches, back 66¼ inches
Fire box, material	Carbon steel
Fire box plates, thickness,	Sides 5/16 inch, back 5/16 inch, crown ⅜ inch, tube sheet ½ inch
Fire box, water space	Front 4½ inches, sides 4 inches, back 4 inches
Fire box, crown staying	Radial stays 1 inch diameter
Fire box, stay bolts	⅞ and 1 inch diameter
Tubes, material	Charcoal iron No. 11
Tubes, number of	342
Tubes, diameter	2 inches
Tubes, length over tube sheets	13 feet 0 inches
Fire brick supported on 2-3 inches Allison special iron tubes,	18 in. thick
Heating surface, tubes	2313 square feet
Heating surface, water tubes	15.75 square feet
Heating surface, fire box	179 square feet
Heating surface, total	2507.75 square feet
Grate surface	30.33 square feet
Exhaust pipes	Single
Exhaust nozzles	4¾ inches, 5 inches, 5¼ inches diameter
Smoke stack, inside diameter	6½ inches at top, 14 inches near bottom
Smoke stack, top above rail	15 feet 1½ inches

Ancient American sleeping cars were commented upon by L. Xavire Eyma, a Frenchman, who came to this country in 1847, in an article in L'Illustration of Paris, published July 22nd, 1848, giving his experiences on the railroads of the United States. He said that at that time the Baltimore and Ohio Railroad had a length of seventy leagues and that the cost of the road was 4,116,744 francs, the receipts 3,983,456 francs and expenses 1,964,741 francs. He also gave considerable space to the interior arrangements of the sleeping cars used at that time and says that "they are actually houses where nothing is lacking for the necessity of life and are divided into compartments and sleeping rooms, some for men and some for women." Each room held six beds or rather little couches in three tiers along the sides. He winds up his account by saying that valuables were not particularly well taken care of, as in America there "were no such things as sneak thieves."

NEW WORKS OF THE BULLOCK ELECTRIC MFG. CO.

As an example of the advance which is being made in the large manufacturing establishments of to-day, attention is called to the new manufacturing plant of the Bullock Electric Manufacturing Company of Cincinnati, Ohio. There is no better example of a complete and modern plant in this country.

The new establishment was completed last summer, and was occupied the first of the present year. The buildings are located at East Norwood, Ohio, one of the suburbs of Cincinnati, which is less than five miles from the heart of the city. The B. & O. S. W. Railroad crosses the Pennsylvania lines at this point, and both roads have tracks entering the works, giving the Bullock Company excellent shipping facilities.

Perhaps the first impression received by the visitor to the works is the simple yet exceedingly attractive architecture of the several buildings; second, the great amount of light and general cleanliness within. The buildings are constructed of light buff pressed brick with appropriate trimmings of stone, and separated from each other by grass plots, flowers and shrubs.

It is difficult to think of anything which would facilitate and render more comfortable the pursuit of duty by officer, clerk or workman in the new plant than these light, airy and pleasant surroundings; and a vast amount of thought and care, not to mention expense, has been necessary in securing these results.

The plant comprises the administration building, machine shops, foundry and power house.

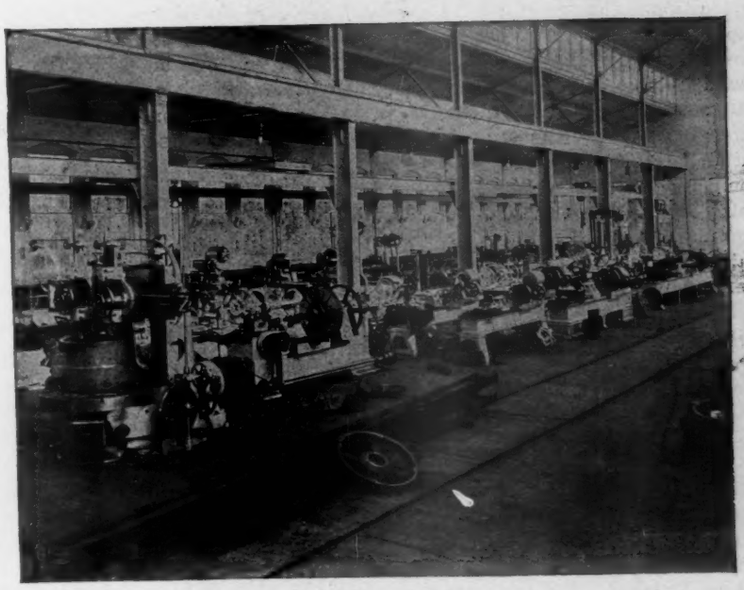
In the first of these are the general offices, drafting and pattern rooms, lunch room for officers and heads of departments, with a complete equipped kitchen and pantry, general lavatory and locker rooms for workmen.

The dressing room section set apart for mechanics and shop employees is not only provided with the usual toilet arrangements for the men, which are thoroughly modern in every detail, but there is also a complete system of lockers and baths. Each man has a locker under key placed at his disposal, and in the lavatory are set bowl, shower and needle baths.

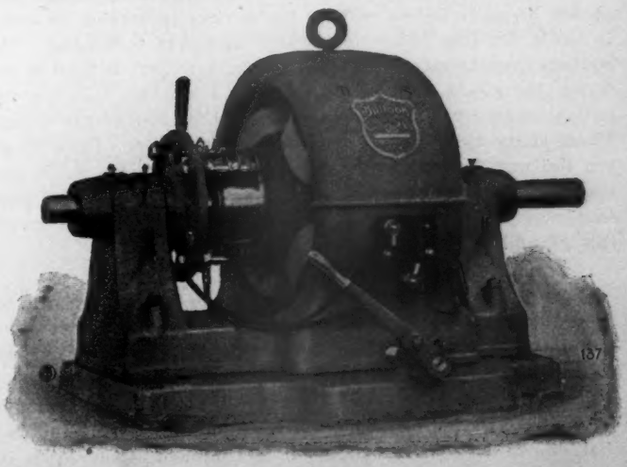
The machine shops of the Bullock Works are interesting as illustrating the great economic progress made in manufacturing methods. There are no long lines of shafting and countershafting; no belts; each machine in the Bullock Works is driven by an independent Bullock electric motor, which absorbs power from the transmission lines only when it is required.

Among the machines equipped may be mentioned cranes, power presses, lathes, planers, drills, milling machines, profilers, emery grinders, hydraulic presses, boring mills, etc. The motors used for driving these various tools are designed and adapted for the tools mentioned, and are built into the headstocks of lathes, while in other tools they take the place of the driving pulley and require no additional room. The motors are of the Bullock slow-speed type with the variable speed control governed by the Bullock multiple voltage system. The tools may be operated in six varying speeds in either direction, without the use of back gearing or any resistance in the electrical circuits.

Machine Shop.



Machine Department.



Bullock Belted Motor.

The power house is provided with vertical water tube boilers, equipped with automatic stokers. A cross compound engine direct connected to two of the Bullock Electric Manufacturing Company's engine type generators, supply current not only for the lighting system, but for the Bullock multiple voltage power transmission system used throughout the entire plant. An elaborate switchboard has been erected with the necessary electrical instruments and switches, including recording wattmeters registering the amount of power being used on the various circuits. A section of this building, occupying the whole southerly end, is set apart and fitted out for the employees' lunch room. Apparatus for heating the general machine shops is located in the basement of the power house, and hot air is conveyed hence underground to its destination.

Altogether the plant is a notable one, and one which is worthy of a visit from any manufacturer contemplating a change of power or material reconstruction of shops of any kind. There are many large plants in the country, but the Bullock Company may safely assert that there are none more nearly up-to-date in equipment, from a manufacturer's point of view.

The officers of the Bullock Electric Manufacturing Company are: George Bullock, president and treasurer; J. S. Neave, vice-president, and James Wilson Bullock, secretary.

The lack of uniformity in the details of M. C. B. couplers of various makes has given rise to a great many suggestions for improvement, of which those summarized as follows are the most sensible we have seen: The so-called "vertical plane" idea does very well, the difficulties, which have now become rather serious, being due to the fact that there are over one hundred makes of couplers in use, in which there are slight but important differences, both as to contour and construction. Much as it is to be desired there is no hope of securing a single standard coupler, and the best that is to be done is to require sufficient uniformity so that couplers will work together, and then to make specifications as to strength and operation rigid enough to weed out unsatisfactory designs. This may be done by purchasing on specifications calling for the desired strength of material and including proper drop tests. Accurate agreement with the established contour lines is absolutely necessary. It is not sufficient that the limit gauge should be introduced, but the lines should coincide with the M. C. B. lines when referred to the center line through the coupler shank. The guard arm needs attention, and its outline should be continued at least three-quarters of an inch beyond the present limits. Nothing is more important in connection with couplers than service records showing where and why failures occur, and from which comparative wear may be obtained. The pivot pin hole should be located positively and greater accuracy of fitting should be urged. The lock should be positive and so made that it will not jump or crawl open in service, and the most thorough tests of this part should be made before putting the devices in service, in order to avoid flooding the country with unsatisfactory ones. The contour lines appear to be satisfactory, but there is need of defining the guard arm at the point and also for locating the entire contour with reference to the center line of the shank. These suggestions were reported by a committee of the Western Railway Club at a recent meeting. To this we would add that railroads should be prepared to pay a proper price for good couplers. The recent action of the M. C. B. Association covers this ground almost completely.

Large freight cars, 38 feet 4 inches long, are being built by the Caledonian Railway (England). The first lot have been completed and have entered service in carrying coal for the locomotives of the road. The cars carry 50 tons and the plan is an experiment from which the advisability of building larger cars will be judged. The possibilities may be seen by the fact that one of these large cars will accommodate the loads of seven of those in general use on the road in the same service.

FREIGHT LOCOMOTIVES, MIDLAND RAILWAY, ENGLAND.

Built by Schenectady Locomotive Works.

The Schenectady Locomotive Works have sent us photographs and information concerning the much talked about mogul freight locomotives which have just been completed for the Midland Railway, England. The design is essentially in accordance with American practice and but for the six-wheel tender, the copper flues, staybolts, firebox and a few minor details, the engines would look "at home" on one of our roads. The long taper sheet in the boiler attracts attention and also the cab. The latter feature will probably be appreciated by the locomotive crews for the protection it affords. The limitations imposed upon the width of English locomotives by the narrow clearances are clearly seen in the flattened cylinder casings. It is customary to flatten the castings of the low-pressure cylinders of American two-cylinder compounds when the diameters approach three feet, but a good idea of the difficulties on English roads is given by the necessity for doing this with 18-inch cylinders. The reports of service records of these locomotives, if they are made public, will offer subjects for advantageous study on both sides of the water owing to the possibility of comparing methods of construction. We hope the results will be available. The chief dimensions of the locomotives are given in the following table:

General Dimensions.

Gauge	4 ft. 8½ in.
Fuel	bituminous coal
Weight in working order	107,000 lbs.
Weight on drivers	89,000 lbs.
Wheel base, driving	15 ft. 6 in.
Wheel base, rigid	15 ft. 6 in.
Wheel base, total	23 ft. 0 in.

Cylinders.

Diam. of cylinders	18 in.
Stroke of piston	24 in.
Horizontal thickness of piston	5¼ in.
Diam. of piston rod	2¾ in.
Kind of piston packing	cast iron
Kind of piston rod packing	United Kingdom
Size of steam ports	16 in. x 1½ in.
Size of exhaust ports	16 in. x 3 in.
Size of bridges	1⅛ in.

Valves.

Kind of slide valves	Allen, American
Greatest travel of slide valves	5 in.
Outside lap of slide valves	1 in.
Inside lap of slide valves	line and line
Lead of valves in full gear	1-16 in.
Kind of valve steam packing	United Kingdom

Wheels, Etc.

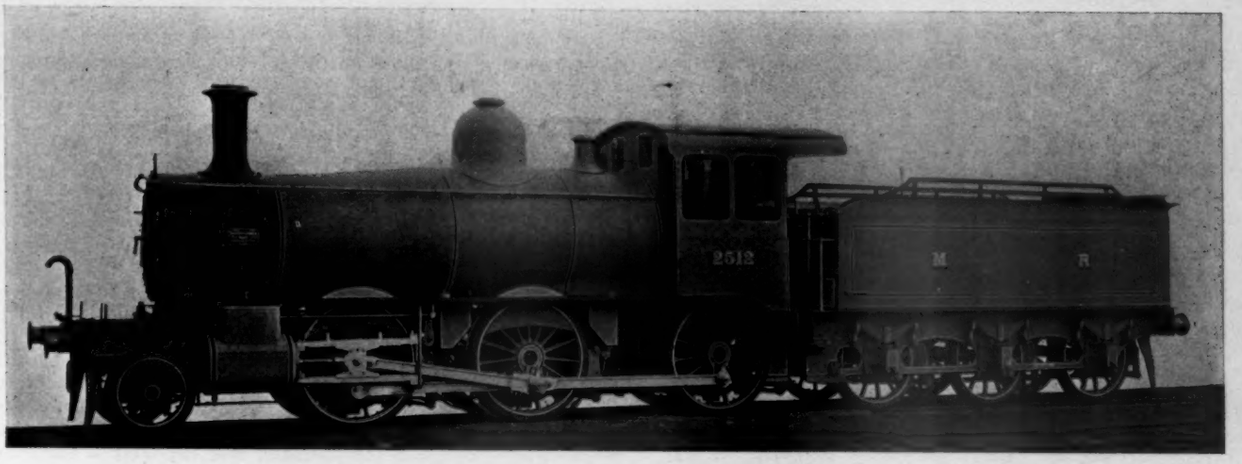
Diam. of driving wheels outside of tire	60 in.
Material of driving wheel centers	cast steel
Tire held by	lip and ⅞-in. screws between spokes
Driving box material	cast steel
Diam. and length of driving journals	7½ in. dia. x 8 in.
Diam. and length of main crank pin journals	5 in. dia. x 5 in.
Diam. and length of side rod crank pin journals.	front 4½ in. dia. x 3 in.; back 4½ in. dia. x 4 in.
Engine truck, kind	2-wheel swing bolster
Engine truck journals	5½ in dia. x 9 in.
Diam. of engine truck wheels	36 in.
Kind of engine truck wheels	cast steel spoke

Boiler.

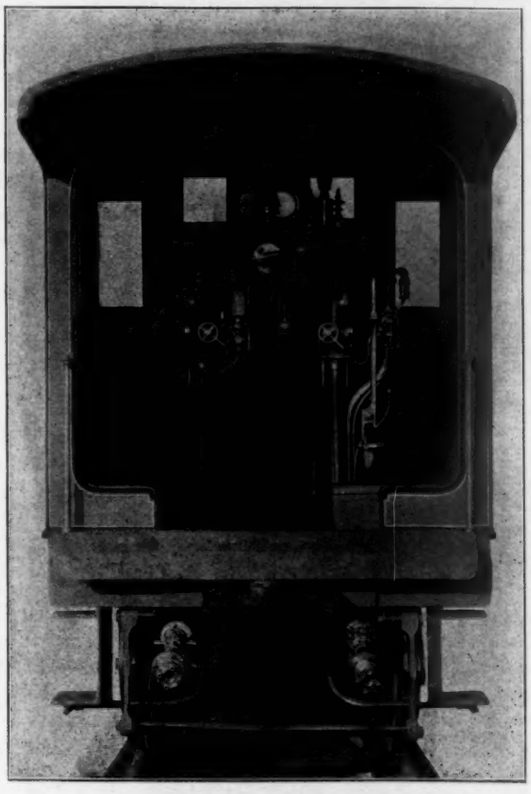
Style	extended wagon top
Outside diam. of first ring	54⅛ in.
Working pressure	160 lbs.
Material of barrel and outside of fire box	Worth "Basic" steel
Thickness of plates in barrel and outside of fire box	⅝ in., 9-16 in., ½ in., ¾ in.
Fire box, length	72 in.
Fire box, width	31¾ in.
Fire box, depth	74½ in.
Fire box, material	copper
Fire box plates, thickness	sides, ½ in.; back, ½ in.; crown, ½ in.; tube sheet, ½ and ¾ in.
Fire box, water space	4 in. front, 3 in. sides., 3 in. back
Fire box, crown staying	crown bars 5 in. x ¾ in. welded at ends
Fire box, stay bolts	copper, 1 in. dia. 11 thd's
Tubes, material	copper
Tubes, number of	244
Tubes, diam.	1⅝ in.
Tubes, length over tube sheets	5 ft. 0 in.
Fire brick, supported on	studs
Heating surface, tubes	1128.87 sq. ft.
Heating surface, fire box	126.46 sq. ft.
Heating surface, total	1255.33 sq. ft.
Grate surface	15.87 sq. ft.
Exhaust pipes	single high
Exhaust nozzles	4¼ in., 4½ in., 4¾ in. diam.
Smoke stack, inside diameter	16 in. at top, 14 in. near bottom
Smoke stack, top above rail	12 ft. 9½ in.
Boiler supplied by	2 injectors, Gresham & Cravens

Tender.

Weight, empty	43,800 lbs.
Wheels, number of	6



Mogul Freight Locomotive—Midland Railway, England.
Built by Schenectady Locomotive Works.



Interior View of Cab.

Wheels, diam.	50¾ in.
Journals, diam. and length	5½ in. dia. x 9 in.
Wheel base	12 ft. 3 in.
Tender frame	steel plate
Tender trucks	wheels on axles in pedestal boxes
Water capacity	3,250 imperial gallons
Coal capacity	6 (2240 lb.) tons
Total wheel base of engine and tender	43 ft.

PROGRESS IN PINTSCH GAS LIGHTING.

A report recently prepared by the Julius Pintsch Co. of Berlin, shows in detail the number of cars and locomotives which have been equipped with Pintsch gas lighting on the railroads of a large number of countries, and including statements with regard to gas buoys and Pintsch gas manufacturing plants.

The report shows that there are 90,890 cars, 3,650 locomotives and 892 gas buoys and beacons using this system, with 303 gas plants for making the gas required for them. It also states that the Midland Railway (England) has 2,454 cars fitted with this system, and operates 9 gas plants; also that the London, Brighton & South Coast has 1,647 cars so equipped, requiring 5 Pintsch gas works. It is stated that these are specially mentioned because these two roads were the first in England to experiment with electric lighting from the axle in 1890, each road had from 400 to 500 cars thus equipped, and the system was abandoned after several years' experience because it was found to be too expensive to maintain and too uncertain in operation. In this statement the conclusion is drawn that neither of these roads would have given up the electric system after so much expense in its development and adopted the Pintsch system, involving additional investment in equipment and gas making plants, unless it has been conclusively proved to be to their interest to do so.

A condensed statement drawn off from the complete report is presented in the following table:

	Cars.	Locomotives	Gas Works.	Buoys and Beacons.
Germany	34,325	3,566	71	98
Denmark	45	....	3	21
England	17,800	....	87	193
France	5,210	....	22	188
Holland	3,012	5	9	58
Italy	1,522	....	4	....
Switzerland	371	2	1	12
Austria	3,111	....	10	1
Russia	1,943	50	13	13
Sweden	379	....	4	1
Servia	154	....	....	....
Bulgaria	33	....	1	....
Turkey	103	....	....	....
Egypt	2	....	3	112
Canada	20	....	2	14
Brazil	967	31	1	31
Argentine	984	....	10	....
Chili	46	....	1	....
India	6,458	....	10	....
Australia	1,000	....	3	29
United States	13,405	....	48	121
Total	90,890	3,654	303	892

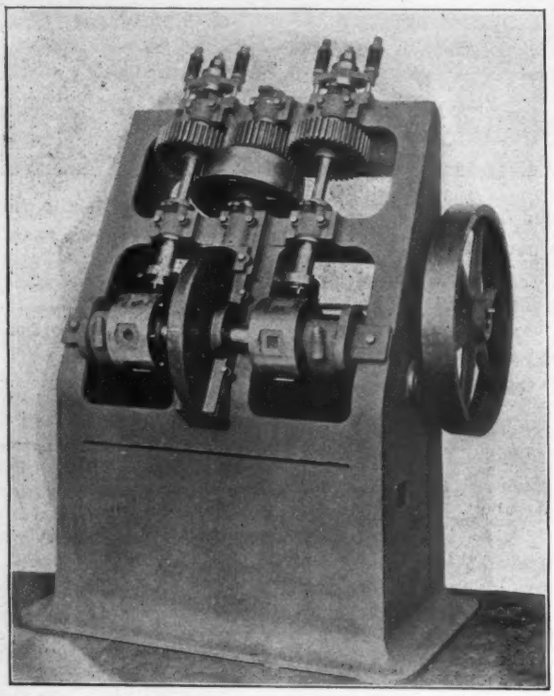
AN ATTACK ON MERCANTILE AGENCIES.

A bitter complaint against the old established mercantile agencies was made at the recent Buffalo meeting of the National Association of Credit Men. The committee on the improvement of the Mercantile Agency included the following in a set of resolutions forming a part of its report:

Resolved, That the National Association of Credit Men in convention assembled records its dissatisfaction at the disregard which has been paid by the old agencies to the suggestions for the improvement of their service offered by the delegated committees of this organization, and further records its belief that if a continuance of this same spirit of independency and inattention as to reasonable requests is continued the time will then be ripe for the development of a new agency, the policy of which shall be accuracy in reports and a constant endeavor to comply with the suggestions of practical credit men as to what is important and desirable in agency reports and service.

BURDICT NUT BURRING MACHINE.

This is a new machine which is much needed in the manufacture of nuts. It is designed to burr hexagon and square nuts from one inch in size down through the smaller sizes. The photograph shows the construction and the positions of the nut cylinders and the cutters. The machine is intended to be operated by two boys, who place the nuts in the nut holders. The cylinders carry them under the knives and rise automatically to the knives. When the burrs are taken off the



The Burdict Nut Burring Machine.

nut is dropped, carried around and discharged from the cylinder. The knives are flat and are easily ground, and the form is such that they are also easily made for replacement. It is obvious that the operators' fingers are not in danger of contact with the cutters because the nuts are inserted in the sockets before they are brought near the cutters. It is stated that the repairs to these machines do not amount to $5.00 per year. Further information may be obtained from Mr. O. C. Burdict, White Building, Buffalo, N. Y.

COMMUNICATIONS.

VARIETY IN LOCOMOTIVE DESIGN.

Editor "American Engineer":

In making a comparison of locomotives of a similar type, the most striking thing to attract attention is the numerous and various methods resorted to in order to get locomotives of practically the same power, constructed so widely different in important details. For example, a certain combination of cylinders, pressure and wheels, with heating and grate surface known to fill the requirements, will be given an engine, and to all appearances the experiment is a successful one. Some other designer will create a machine for exactly the same service and there will be nothing in common between the two engines. One may have its power based on a high boiler pressure, a small cylinder with long stroke and comparatively large wheel, the other may have a larger cylinder with shorter stroke, the same boiler pressure and larger wheels. These factors may be so manipulated as to give identical results as to power, but there may be, and often is, a strong dissimilarity in the economy of their performance. This point is open to comment as reflecting discredit on some features of design that cannot by any stretch of imagination be classified as correct. The relation of stroke to cylinder diameter is not as well defined as many other locomotion proportions, and on that ground diversity in those details may be expected, but the query, why there should be such a difference in practice on matters now clearly understood in their effect on locomotive economy, is one that will strike most mechanical men as a pertinent one. RONALD HAYDN.

BURNISHED FINISH FOR JOURNALS.

Editor American Engineer:

Your paragraph at the bottom of page 157 of your May issue, relative to the matter of invention of burnished journals, is correct. So far as I know, this roller was designed by myself at this shop. Formerly we had a great deal of trouble in attempting to get our journals smooth. We had tried all the schemes imaginable or known to the art to get a smooth surface. It occurred to me one day as I was standing near the lathe where we finish the journals, that probably a burnisher would put the required surface upon the journal. I told the man who was running the lathe to the brass lathe to get a burnisher, had him put the rest in the lathe and attempted to burnish the journal. I found that it was possible to do it, and then suggested that he make a roller and try it; and from that idea the plan of rolling car journals in order to get them smooth has been adopted very nearly over the world.

Missouri Pacific Ry., L. BARTLETT,
St. Louis, May 5, 1899. Master Mechanic.

THE PEARSON KING BOLT CLAMP.

This is a simple device designed for use in wrecking operations when it is desired to clamp the trucks to a car in order to lift them together. The clamp has a U-shaped frame with two grips or cams pivoted at the proper distance apart to seize the king bolt and permit of lifting the truck by it. The king bolt is lifted out of the bolster and the clamp inserted under the bolster and lengthwise of the car, the space for the bolt being under the bolt. Then when the bolt is dropped into place the

Pearson King Bolt Clamp.

cams close upon it on account of the weight of the overhanging ends, and the truck may be lifted with the bar. This is a better and quicker way than chaining the trucks to the car body. In chaining freight car trucks it is often necessary to cut holes through the floor, and in such a case this clamp will save time and trouble. It is easily applied and it offers the additional advantage of holding the truck springs in place. The device is made by the Pearson Jack Co., 64 Federal St., Boston.

SUPPRESSION OF SMOKE.

Under the above title Dr. R. H. Thunston contributes an article to "Science" printed recently, in which he reviewed the status of smoke prevention both here and abroad, citing St. Louis as having been as successful as any other city in this country in reducing the smoke nuisance, and attributing the good results attained to the co-operation of the city government, the Board of Trade and the scientific men and leading engineers of that city. The recent discussions at Philadelphia under the auspices of the Franklin Institute (Journal Franklin Institute, June, 1897) were also referred to as having thrown much light upon the subject, and affording many valuable facts and data.

The author also said: "We have now the published results of another and formal investigation by a commission organized at Paris, composed of MM. Hurt, Brull, Hirsch, Humboldt, Lamouroux, Michel-Levy and De Tavernier, all holding important positions in the municipal administrations, or in the great schools of mines and engineering, or as leading members of the Society of Civil Engineers. The commission was in session at intervals from June, 1894, to October, 1897. It made a study of reports upon the subject, conducted important experiments, reduced them to order and studied out definite conclusions, and also investigated the origin, state and progress of the art, completing its report at the last named date. This document of over 150 pages is now in process of distribution.

The commission was to select acceptable forms of furnace and report to the city government for their license and use. The schemes of the 110 competitors include the following:

1. Mechanical feed and methodical combustion	16
2. Supplementary injection of air, hot or cold	20
3. Injection of steam, with or without air	5
4. Stirring of the gases	7
5. Gas producers and heating the gases	7
6. Combustion of dust fuel	2
7. Washing the smoke	16
8. Various other systems	37

The tests included rapid and slow combustion, and intensity of the smoke was observed and noted on a scale of five points; the usual methods of determining the efficiency of the apparatus being employed.

The history of legislation, as given, traced the progress of the subject in England from the time of Charles II., who, two hundred years ago, inaugurated repressive measures. In France, this form of legislation began with an imperial decree in 1810. Both countries now having well considered laws for suppression of smoke in cities. The technical history of the subject, curiously enough, begins with plans by Denis Papin. The next inventor to follow this illustrious man of science was James Watt, with his inverted draught, and later arrangement of dead plate. The automatic stokers, are referred to and their incidental but none the less effective, smoke reductions are described. Legislation now exists in all civilized countries, and many more or less effective devices and methods are in use for suppression of smoke.

Germany has also done some work in the line of investigation, a commission of distinguished engineers having been appointed by the Government in 1892, who, after prolonged experiments, concluded that success had not been attained, but that the way to success was clearly indicated.

The outcome of the French commission was the refusal to assign a first prize, awarding of two second prizes, of two first mentions and one second mention. The conclusions formulated indicate that the commission is not satisfied that a real success has been achieved, but nevertheless the researches were not without value. Like the German commission of 1892, it is concluded that the work of the commission should be considered only as a contribution to the study of smoke suppression, and it is to be hoped that these researches may continue. There remains much to be done, and a part of this collection of exhibits has very nearly attained the object proposed.

Among the specific conclusions are these:

Smoke cannot be suppressed without considerable excess of cost.

Special fuels, as anthracite, coke, fuel-gas and mineral oils, may be resorted to, and with success, where cost is not objectionable.

The chimney-top should be visible to the man at the furnace.

Prolonged trials should supplement such investigations as those prosecuted by this commission, to ascertain the durability of the apparatus and of its efficiency.

Existing legislation, well enforced, is advised, rather than any specific new legislation.

COMMUNICATION BETWEEN RAILROAD CARS IN ENGLAND.

A recent communcation to the "Times," London, illustrates the importance of the establishment of a proper method of communication between the passengers and the "guards" on English trains, or what is better the provision of train valves for the application of the air brakes after the manner of the Westinghouse conductor's valves. All of the present troubles arising from the use of compartments without methods of communication seem to us entirely unnecessary and this danger of being roasted alive certainly should not be lightly passed over. The letter is as follows:

I yesterday had an ugly experience of the unreliability of the present system of communication by cord between railway passengers and the guard.

I came to London by the Scotch express, timed to reach Grantham at 4.23.

At about 3.45 a gentleman in the next compartment opened the communicating door, and called our attention to the alarming fact that the ceiling of the lavatory common to the two compartments was in flames. I immediately pulled the outside signal cord, which first stretched considerably, and then broke. I then pulled in the other direction, when the cord again gave way. I then went to the cord on the opposite side of the carriage, with the same result.

The cords were broken in four places, and there was no possible means of communication with either guard or engine-driver. In the meantime the other occupants of the carriage, five in number, devoted themselves to soaking towels and railway rugs in water, of which, happily, there was a supply in the cistern of the lavatory, and, by applying these to the flames, the spreading of the fire was arrested.

At last the supply of water came to an end, and soon after this the flames burst out in the cornice of the carriage adjoining the lavatory. This was a few minutes before we arrived at Grantham. The ceiling appears to have been of a material not very inflammable, and this, and the fortunate supply of water were the only factors in the case which prevented a most serious accident.

I may add that every effort was made to attract the attention of those at the stations we passed on the road, but without effect.

As the means of communication between passengers and guard are notoriously inadequate in this country, I do not apologize for asking space in your valuable paper, in the hope that it may cause some change to be made.

THOMAS WRIGHTSON.

Artificial draft produced by blowers not only permits of saving a large proportion of the cost of construction of chimneys, but also permits of burning cheap grades of fuel. Three Babcock & Wilcox boilers, rated at 355 horse-power each, at Central Falls, R. I., furnish power for a 1,500 horse-power Harris-Corliss compound engine. Cumberland semi-bituminous coal was used, because the draft was not strong enough for cheaper fuel. A mechanical draft plant was put in at a cost of about $600, which made it possible to use a mixture of coal that cost $2.29 per ton, which means a saving of $6,500 per year in coal. This mixture included anthracite dust and buckwheat, with only 7 per cent. of Cumberland.

(Established 1832)

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The use of oil as fuel for forging furnaces was such a marked improvement upon solid fuels that oil furnaces have been introduced very generally and quite rapidly with satisfactory results. The immediate advantages gained were so great as to throw the matter of oil consumption somewhat in the background, because of the fact the most wasteful use of oil effected a marked saving over the most careful use of solid fuel. The time has now come, however, for the saving which may be effected by the best of oil burners, which consists in perfecting the methods for atomizing or "pulverizing" the oil. On page 195 of our June issue we printed a discussion of this subject, and in connection therewith it is interesting to note that the experience mentioned is corroborated in a paper by Sir Marcus Samuel, read before the Society of Arts (England) recently. The system described in the paper is based upon very perfect combustion of oil by air, which is supplied at a pressure of 50 pounds per square inch and heated to a temperature of 500 degrees F., by passing it over cast-iron plates in the furnace. For complete combustion it is found necessary that the oil be very finely sprayed on entering the furnace, and this, as we understand it, is the secret of the success of oil burning under marine boilers abroad.

The necessity for an occasional inspection of the sheets in the barrel portions of locomotive boilers was emphasized in one of the discussions at the recent meeting of the American Society of Mechanical Engineers. Prof. Forrest R. Jones told of a locomotive boiler, made in 1867, which exploded recently on account of grooving more than two-thirds through the sheets, which were of iron. Tests showed that the metal had an elastic limit of 24,000 lbs., an ultimate tensile strength of 45,600 lbs. and an elongation of only 2½ per cent. The plate could not be bent to an angle of 90 degrees without breaking, and it was evident that the preparation for destruction had been going on a long time. One of the inspectors of the Hartford Steam Boiler Inspection & Insurance Co. was quoted as saying that an inspection of the sheet ten years before the explosion would probably have shown a dangerous condition at that time. Another stated that it would have have shown it five years before. These parts receive less attention than those which give more trouble, but they should be inspected.

Vacation work in railroad and locomotive building shops for students in railroad mechanical engineering at Cornell University is urged by Prof. H. Wade Hibbard in a pamphlet recently received from the author. We heartily commend the idea of urging practical experience for students, not only because of the educational advantages which it offers, but because of the value of coming into contact with hard-headed men and the opportunities which this plan affords for boys to gain the confidence of those who have succeeded in difficult work. A caution seems necessary, however, lest this vacation idea should lead young men away from the fact that a thorough knowledge of shop work is necessary to a proper foundation for successful practice.

The selection of wood in preference to steel for the construction of 50-ton capacity cars is surprising at this stage in railroad progress, yet one of the best of the railroad journals has just expressed the following opinion in regard to wooden box cars of this capacity:

"The choice of wood as a material of construction will strike some engineers as remarkable and calls for a word of explanation. After careful analysis it was found that a light steel car for 100,000-pound loads was practically out of the question. In tensile or bending strength, weight for weight, wood is the strongest material known in the arts."

If this is true the steel car is all wrong and a mistake has been made in building the pressed steel cars exhibited at several recent M. C. B. conventions, when new and after the severest kind of service, and which, but for the abrasion of paint, were as good as new. This position is astonishing and is a step backward, which has no support in recent experience with lightweight steel cars of large capacities. We have long been on record on the steel car question and it is not necessary to reopen a discussion that is considered definitely settled unless the words quoted prove to have more effect in favor of the wooden car than is expected. As to the relative strength for a given weight of wood and steel in tension or bending, no comment is necessary.

Among the improvements which are necessary with ordinary car equipment and more imperative with increasing loads and severity of service are those which will reduce the number of hot boxes and decrease the expense for bearings. The bearing now provided on car journals is limited in extent and it is most important that the load should be uniformly distributed and not transmitted to a point or a small portion of the bearing only. The load should be brought to the journal by some automatically adjustable connection which will insure a uniform pressure of the brass to counteract the effect of the tilting of the truck frames as in passing over low joints or around curves. To accomplish the uniform loading the brass must be sufficiently stiff to act as a girder and transmit the load without deflecting. The tendency is to increase the amount of metal in the brass to accomplish this result and this is a seri-

ous matter with the present high price of copper. The brass should be made stiff without unduly increasing the amount of bearing metal that is not essential to the bearing surface itself and its immediate support. The whole arrangement should be perfectly interchangeable with the M. C. B. standard in order to be satisfactory. If these conditions can be fulfilled in a bearing it ought to be successful. The concentration of loading by tilting the brass is undoubtedly the most frequent cause of hot boxes.

THE M. C. B. CONVENTION.

In an examination of the work of the recent convention of the Master Car Builders' Association several decisions stand out with special prominence. First, the provisions for improving the coupler situation; second, the adoption of a standard axle for 100,000-pound cars; third, the standardization of car sills; fourth, the settlement of the question of an allowance for the repairs west of the 105th meridian and, fifth, the rearrangement of the time of holding the conventions whereby it will be possible to hold the Master Car Builders' and the Master Mechanics' Association in one week.

The coupler question is the most important now before the association and the action taken was based upon a report in which recommendations were made after a thorough study of the present conditions. They were conservative and practical, so much so in fact that the work of the committee was endorsed almost exactly as it was presented. The plan was to improve the coupler on the present lines and to provide for the weeding out of inferior and dangerous ones by the adoption of exacting specifications. To insure that couplers shall be correct in form when new and to provide against unsafe wear, excellent gages were adopted. The lines were unchanged except to extend the guard arm. This is all that can be done now and the conduct of the whole matter will undoubtedly give general satisfaction. The standing committee on couplers has important work to do and its appointment, as reported elsewhere in this issue, was a fitting conclusion to the transaction.

A standard "100,000-pound axle" was greatly needed because of the large number of cars of this capacity which are being built. The new design comes none too soon and if it had been attended to a year earlier nearly all of the large capacity cars might have been provided with journals of the same size. No time should now be lost in getting the standard into use.

A standard car of any capacity is a dream which, however desirable, we do not expect to realize completely, although a near approach to uniformity may be secured. An important step has been taken in confining the sizes of sills within limits, and as this work is to be extended next year, to the car sides and roofs, it is evident that there is a general awakening to the possibility of accomplishing that which might and should have been done years ago.

The allowance for the difference in cost of car repairs east and west of the 105th meridian was settled very quickly. It is a difficult question and one that must not be considered as a department question only. The revenues of the western roads have a great deal to do with it and the discussions of this year and last indicate the necessity for considering such questions from the standpoint of the railroad as a whole rather than as a matter concerning the department upon which the burden appears to fall.

Consolidation of the two associations appears to be as far away as ever, but the most important argument in favor of such action loses its strength when the two conventions may be held in the same week and the opening exercises are combined in one general session. The new order compels most careful selection of a place of meeting because it will mean that more people will be in attendance than in either week under the old arrangement. This clearly points to Saratoga as a desirable location, because there is no doubt of its capacity and comfort, and every precaution should be taken to insure the success of the first convention under the new plan. Saratoga is most generally favored by those who attended the recent conventions.

THE MASTER MECHANICS' CONVENTION.

It is evident that the Master Mechanics' Association is not ready to endorse the plan of organizing a research laboratory such as was outlined in the report presented this year, and with further consideration it is probable that opinion will not grow to be more favorable in spite of the arguments that were brought forth by the able committee at the recent convention. The subject was too large to be grasped on short notice, and it is the opinion of many that it grows larger and more difficult all the time.

The treatment of boiler waters for the prevention of the formation of scale was very ably handled by a painstaking committee, and a great deal of information was presented in the report, but one of the most promising methods of improvement, the use of feed water heaters, was not given the place that it appears to have earned by its success in other branches of steam engineering. These devices claim attention not only because they heat the water, but also because they serve to prevent a great deal of the trouble with scale. They have been successful in this direction in France, as we shall soon be able to show our readers.

The cast-iron wheel had strong support from several speakers, and the opinion was expressed that for every service except that of guiding the front ends of the trucks of heavy engines the cast-iron wheel was equal in safety to the steel tired wheel. This, however, may be taken as a confession of weakness in the cast-iron wheel, although that was probably not intended. It may be asked why the specification of steel tired wheels for locomotive trucks is not at once an admission that this type is the safer of the two and why this does not constitute an unanswerable argument in favor of the use of steel tired wheels in locomotive and passenger service. It is evident from this discussion that the steel tired type is considered the stronger, because it is selected for the severest service.

The advantages of the ton-mile basis for locomotive statistics were generally admitted and it is probable that this idea will extend and that it will soon come into general use.

The form of stay bolts did not receive attention this year, the time being occupied in considering methods for preparing and applying them. This is the first time that so much attention has been given to methods for cutting threads on stay bolts, and it is now apparent that its importance is appreciated. The best opinion seemed to be that lead screws should be used as a final reference in making the dies and taps and that daily comparisons with correct gages should be insisted upon.

The practice of using flanges on all driving wheel tires of mogul, consolidation and ten-wheel locomotives apparently does not increase the resistance of the engines in passing around ordinary curves, and the advantage of saving the expense of carrying two kinds of tires of each size in stock is quite important. There seems to be a difference of opinion as to the possibility of doing away with blind tires altogether, but the opinion that this is possible seems to be growing. It is noticeable that none who have used flanges on all driving wheels of these engines have found trouble to result from so doing.

Nickel steel, while one of the important subjects, was disappointing in the discussion, for very little was said about it in the convention, and beyond knowing where to look for the literature of the subject, the association is not much wiser for having considered it. The one fact that was brought out in the convention was that it is most important that the heat treatment of nickel steel shall be better understood before it is used more generally. The proper ways to handle nickel steel in the shop should be considered by the association in time to prevent it from being charged with failures for which the material itself is not responsible.

Comments on other points brought out in the discussions are made elsewhere in this issue.

PERSONALS.

FRANK THOMPSON.

The death of Frank Thompson, President of the Pennsylvania Railroad, removes one of the best of American railroad men. There are few men of his ability and high, strong character, and his death is a national loss. His life was a brilliant example. It was one unbroken effort to conscientiously serve the Pennsylvania Railroad, the only employer he ever had.

Mr. Thompson was born in Chambersburg, Pa., in 1841. His father was a lawyer and judge. He was educated at the Chambersburg Academy and went directly into the Altoona shops, where he worked four years until called to the government service under Thomas A. Scott, then Assistant Secretary of War, in special charge of transportation during the Civil War. At the age of 20 years his work was to put the Orange & Alexandria and the Loudon & Hampshire roads into serviceable condition after the destruction by the Confederate army. This restoration extended to the city of Washington and gave the necessary rail communication to the capital. His next work was near Nashville, where he was equally successful.

Returning to the Pennsylvania in 1864 he was appointed Division Superintendent and in 1873 was made Superintendent of Motive Power at Altoona. About a year later he was appointed General Manager of the lines east of Pittsburgh and Erie; in 1882 he became Second Vice President, and in 1897 he succeeded Mr. Roberts as President.

One of his chief characteristics was a thorough knowledge, gained through experience, of the details of railroad management. He was a good executive and a shrewd and careful organizer. While a master of detail he fully understood the relations between small and large questions. He was intelligent, energetic and sympathetic. He possessed the ability to succeed in a position of great responsibility and few men leave more and warmer friends.

Mr. A. J. Cassatt has been elected to succeed the late Frank Thompson in the Presidency of the Pennsylvania Railroad. Mr. Cassatt was born in Pittsburgh in 1839 and completed his education at the Rensselaer Polytechnic College, Troy, N. Y., where he graduated in 1859 as a civil engineer. His first railroad experience was in the location and construction of a railroad in Georgia. In 1861 he became a rodman on the Philadelphia division of the Pennsylvania Railroad and two years later was made Assistant Engineer. In 1864 he was made resident engineer of the middle division. A little later he served as Superintendent of the Warren & Franklin Railroad, and in 1866 was appointed Superintendent of Motive Power of the Philadelphia & Erie at Williamsport. In 1867 he went to Altoona as Superintendent of Motive Power of the Pennsylvania. In 1870 he became General Superintendent and the following year was made General Manager of the road east of Pittsburgh and Erie. He was appointed Third Vice President in 1874, where he remained until 1880. Upon the election of Mr. Roberts to the Presidency in that year Mr. Cassatt became First Vice President and in 1882 he retired to private life. He was elected Director to succeed Mr. Samuel M. Felton in 1883 and two years later became President of the New York, Philadelphia & Norfolk, which position he now retains. He was appointed by President Harrison to the Presidency of the United States Commissioners to the Intercontinental Railway.

Mr. Waldo H. Marshall has resigned as Assistant Superintendent Motive Power and Machinery of the Chicago & North Western to succeed Mr. G. W. Stevens as Superintendent Motive Power of the Lake Shore & Michigan Southern, with headquarters at Cleveland. All of Mr. Marshall's work has been in connection with railroads and his success as a motive power officer is largely due to his experience, unusual insight into mechanical and business matters, combined with good judgment. He served his apprenticeship in the Rhode Island Locomotive Works and with the help of an education, which he secured by his own efforts, he made such progress on entering the drawing room that he was put in charge of that department upon the resignation of the late David L. Barnes. After leaving these works Mr. Marshall was engaged in mechanical engineering work in New York, and soon after went to Chicago to take up editorial work on the Railway Review, after which for several years he was editor of the Railway Master Mechanic. In 1896 he was associated with Mr. M. N. Forney in editing the "American Engineer." In June, 1897, he received the appointment of Assistant Superintendent Motive Power and Machinery of the Chicago & North Western and in the two years of his service on that road he showed such ability as to place him among the ablest mechanical railroad officers of the country. Our readers know him so well that it is unnecessary to say more except to congratulate the officers of the road upon the selection of so valuable a man, and Mr. Marshall upon the appointment to this important position.

Mr. E. E. Davis has just been appointed Assistant Superintendent Motive Power of the New York Central in charge of locomotive work under Mr. A. M. Waitt. Mr. Davis has had a wide experience in which he has shown himself to possess unusual ability in the management of shops and men, the chief characteristic of his work being systematic organization on an economical commercial basis. He has been very successful in securing good work at relatively small cost and is a thorough student of methods of arranging shops and machinery to save unnecessary handling of material. Mr. Davis is 44 years of age. He was born in Durham, N. H., and after working a year in a blacksmith shop he learned the machinist's trade and took up tool making. Later he spent several years in the employ of the Newmarket Manufacturing Co. at Newmarket, N. H. His railroad work began in the shops of the Boston & Maine at Boston in 1881, where he soon became foreman, and in 1885 was made general foreman. He also performed the duties of draftsman at this time. In 1886 he left the road to enter manufacturing and returned the next year as Master Mechanic at Boston. From 1891 to 1895 he was Superintendent of the Boies Steel Wheel Co., and from there, at the request of Mr. Theodore Voorhees, he went to Reading as Assistant Superintendent of Motive Power of the Philadelphia & Reading, the position which he has just resigned to go to the New York Central.

Mr. F. W. Brazier has resigned as Assistant Superintendent of Machinery of the Illinois Central to become Assistant Superintendent of Motive Power and Rolling Stock of the New York Central & Hudson River Railroad, with headquarters in New York. Mr. Brazier, while a comparatively young man, has had a very wide experience of 21 years in railroad work. He began on the Fitchburg Railroad in 1878, after serving an apprenticeship in house building in Charlestown, Mass. He remained on the Fitchburg for 15 years, for eight of which he held the position of general foreman of the car shops at Fitchburg, Mass. In 1893 he resigned to become Superintendent of the C., N. Y. & B. Refrigerator Company at Elsdon, Ill., and in 1896 he was appointed general foreman of the car department of the Illinois Central at Burnside, Ill. In seven months he made himself so valuable to the company as to receive the promotion to the position of Assistant Superintendent of Machinery, which he now leaves. Mr. Brazier is admirably equipped for his new position and we are reliably informed that all his promotions have come to him unsought, his advancement having been due to recognition of merit. It is understood that he will have direct charge of the car department of the New York Central system under Mr. Waitt.

Mr. George W. Stevens, who has just resigned as Superintendent Motive Power of the Lake Shore & Michigan Southern, was born at Concord, N. H., in 1847. He entered railroad service

as an apprentice in the shops of the Lake Shore in 1861 and passed through the grades of fireman, locomotive engineer and machinist. In 1872 he was foreman in charge of locomotives and from 1873 to 1883 he was Master Mechanic. In 1884 he was appointed Superintendent Motive Power, which position he held until now. He is one of the best known motive power men in the country.

Mr. G. R. Henderson of the Schenectady Locomotive Works and formerly Mechanical Engineer of the Norfolk & Western Ry. has been appointed to succeed Mr. W. H. Marshall as Assistant Superintendent of Motive Power of the Chicago & Northwestern Railway. The appointment is pleasing to those who know how well Mr. Henderson has filled his previous positions, and Mr. Quayle is receiving many congratulations upon his selection.

Mr. D. C. Courtney has been appointed Superintendent of Motive Power of the West Virginia Central & Pittsburg Railway, to succeed Mr. B. O. Cumback, resigned.

Mr. R. F. Kilpatrick has been appointed Master Mechanic of the Morris and Essex division of the Delaware, Lackawanna & Western, at Kingsland, N. J., to succeed Mr. William H. Lewis, resigned.

Mr. J. Horrigan, Master Mechanic of the Elgin, Joliet & Eastern, has been appointed Superintendent of Motive Power of that road and the Chicago, Lake Shore & Eastern.

Mr. H. M. Wissimir, formerly with the Baldwin Locomotive Works, has been appointed Master Mechanic of the Ohio Southern, with headquarters at Springfield, O., to succeed Mr. H. M. Sehrt, resigned.

Mr. Lester I. Knapp, general foreman of the Lehigh Valley shops at Buffalo, N. Y., has been appointed Master Mechanic of the Buffalo division, succeeding Mr. J. S. Chambers, resigned.

Mr. Edwin T. James has been appointed Master Mechanic of the Lehigh Valley, with headquarters at Wilkesbarre, Pa., to succeed Mr. H. D. Taylor, resigned.

President Van Horne of the Canadian Pacific has resigned and is succeeded by Mr. T. G. Shaughnessy.

Mr. S. A. Crone has resigned as Assistant Superintendent of Motive Power and Rolling Stock of the New York Central & Hudson River Railroad to take a position with the Gold Car Heating Co.

Mr. Thos. Fildes has resigned as Master Car Builder of the Chicago Division of the Lake Shore & Michigan Southern and has been appointed Assistant Superintendent Motive Power of the Long Island R. R.

BOOKS AND PAMPHLETS.

Light Railways at Home and Abroad. By William Henry Cole, M. Inst. C. E., late Deputy Manager, North-Western Railway, India; 334 pages, with plates and illustrations. London: Charles Griffin & Co. Philadelphia: J. B. Lippincott Co. 1899.

The author of this book is evidently an engineer and he has been also a manager of a railroad. He discusses the history and theory of light railroads and compares the practice of different countries. The book is the most comprehensive and complete that we have seen on the subject and it is valuable to those who are interested in providing feeders for existing roads and to the projectors of cheap extensions. The author does not appear to favor any particular gage of track, but he considers the standard gage of a country as possessing the strong claims for consideration that Americans have demonstrated it to have. Our early railroads were all "light" ones and they became what they are because of natural growth. Why not urge the standard gage at the outset? This battle of the gages has been fought to a conclusion in this country and the experience should not be lost. Mr. Cole has arranged the subjects logically and has included a discussion of the English railways, rates and necessities of the farmers. The descriptions of foreign practice cover all of the railroad countries and a chapter treats of road transport as an alternative. An entire chapter is given to the gage question, another to construction and working and one to locomotives and rolling stock. Comparisons of the cost figures given with those of this country would have been much easier if English money terms were used in place of Indian. The book contains a large amount of information which is useful and suggestive in regard to constructing inexpensive spurs. Railroad managers will find it interesting to compare the problems, in this respect, of foreign countries with our own. The author very sensibly suggests the advantage of building light railroads with second-hand material discarded from heavy roads. He discusses tracks, yards, switches, sidings, stations and operation. The book is well printed and well illustrated.

American Railway Association Proceedings. From its Organization as "The General Time Convention" in 1886 to October, 1893 inclusive. Edited by W. F. Allen, Secretary, 24 Park Place, New York. Price $5.

This volume contains a valuable record of the proceedings of the American Railway Association and its predecessors. The record begins with the organization of the General Time Convention in 1886 and is brought down to 1893. The volume is large, containing 755 pages, 8 by 11 inches in size, which is uniform with the regularly issued semi-annual numbers. To show the value of this book it is only necessary to say that it contains the discussions and proceedings which led up to the adoption of the present time system, the standard code of train rules and important deliberations on such subjects as couplers, signals, car mileage and car service. The entire volume, including the appendices, is carefully indexed and this exhibits the care taken in the work by Mr. W. F. Allen, Secretary, of the Association. Mr. Allen's thoroughness and conscientiousness is seen throughout the reports which contain valuable tables and data which he compiled. To many the annual presidential addresses by Col. Haines will be a specially interesting feature. The book is inscribed with the title Volume I., which would indicate that the proceedings subsequent to 1893 are to appaer in the same form, the advantages of which require no comment. Members doubtless have these reports, but their value is greatly increased by combining and indexing them because of the possibility of securing the history of any subject conveniently. The letter press and binding are excellent, the work throughout being very creditable.

International Universal Exposition, Paris, 1900. General information for citizens of the United States of America who desire to become exhibitors. Regulations, classifications. Compiled under the direction of the Commissioner-General for the United States. Chicago, Ill. January, 1899.

This pamphlet contains the law establishing the commission for the United States, the decrees of the President of the French Republic, the staff of the exposition, a description of the buildings and grounds, classification of exhibits, railroad agreements, arrangements for transporting and handling exhibits and decrees with regard to awards. The American Commission has offices in the Equitable Building, New York, the Auditorium Building, Chicago, and at No. 20 Avenue Rapp, Paris.

A B C Telegraph Code Specially Adapted for the Use of Financiers, Merchants, Shipowners, Brokers, Agents, etc. By W. Clauson-Thue. Fourth edition. New York. American Code Publishing Co., 83 Nassau St. 1899. Price, $5.

This code is the most widely used and this edition, which is the fourth, is the best that has appeared. The price is reduced from $7.50 to $5 without a corresponding change in the make-up of the book. The code itself is too well known to require comment. The only criticism we offer is that it should have the title on the back of the book, where it may be seen when standing on a shelf.

Professional Papers of the Corps of Royal Engineers, edited by Captain R. F. Edwards, R. E. Vol. XXIV. 1898.

History of the Pennsylvania Railroad Company, with Plan of Organization, Portraits of Officials, and Biographical Sketches. By William Bender Wilson. Two volumes (6½ by 9 inches). Illustrated. Bound in cloth. Philadelphia, 1899: Henry T. Coates & Co. Price per set, $5.00.

Those who have wished for a written history of the Pennsyl-

vania Railroad from its inception to its present development will be glad to know of the appearance of this book. It is the result of the labor of years and, aside from the fact that it is a record of the Pennsylvania Railroad, it has a value in relation to the wonderful development of this country, to which the railroad systems have contributed. The book gives a history of the construction of the lines east of Pittsburgh and Erie, leased, owned and operated by the Pennsylvania Railroad Company, together with the plan of organization, biographies of the executive and chief operating officials, an account of the jubilee celebration and memorials of the men who during their lifetime contributed to the present condition of the road. The type is large, the binding good, and the illustrations include many of structures that have long since been replaced in the growth of the property. It is a record that many will be glad to have, and not the least of its features are the biographies of the men who have made the road.

Liquid Air and the Liquefaction of Gases. By T. O'Conor Sloane, Ph. D. Published by Norman W. Henley & Co., New York. Price $2.50.

It is too early to print an entirely satisfactory treatise on liquid air and the liquefaction of gases, but the author of this work has brought together the history of the subject and has made a very interesting collection which will be sought for by many who desire to know what has been accomplished with descriptions of the methods and appliances used. There are 17 chapters, seven of which give biographies of the experimenters in this field. The first chapter is on physics and contains the remarkable statement that the theory of conservation of energy has long since been discarded. The second chapter is on heat and its measurement, the third on heat and gases, heat of vaporization and the spheroidal state. In this chapter the relation between temperature and pressure and the subject of "critical temperature" are discussed. Recent apparatus and experiments are described in the remaining chapters. The book is interesting and well worth reading. It is not too deep for readers who have not the advantage of technical educations.

Air Brake Diseases; Their Symptoms and Cure. By Paul Synnestvedt. A revision of "Diseases of the Air Brake System," by the same author. Chicago, The W. F. Hall Printing Co. 1899.

The success of Mr. Synnestvedt's first work on this subject, published four years ago, and the improvement of air brake apparatus since that time have made a new edition necessary. In addition to revising the earlier work, the author has included new matter and has rewritten portions, such as the chapter on pumps. A new chapter on the diseases of the air signal is included and the entire work is much improved. The author's well-known reputation as an authority on all air brake subjects and the increasing importance of useful maintenance render the work a valuable one and it should have an extended distribution.

The Shearer-Peters Paint Co., Cincinnati, have issued a ten-page pamphlet containing recently written testimonials in regard to the service of their paints in several kinds of extremely severe exposure. One who attempts to preserve the literature of protective coatings of iron and steel finds a large accumulation in a short time, but good opinions formed after severe tests are not common. After making an experimental application of paint furnished by this company the Pittsburgh, Bessemer & Lake Erie Railroad recently ordered a large quantity with the statement that it was wanted specially for painting the front ends of locomotives. We have already noted the satisfactory experience of Mr. W. H. Lewis, Superintendent of Motive Power of the Norfolk & Western Railway, with this paint for locomotive smokeboxes. This pamphlet also gives records of fire-proof paint and paint used under water and subjected to the action of steam and of powerful acids. Pyro paint is a coal tar product secured by a process which is stated to eliminate the destructive elements of the tar and at the same time renders it non-combustible. For this reason the manufacturers give a guarantee in strong terms for Pyro paint as a coating for locomotive smokeboxes. They also give a strong guarantee for the paint used on roofs.

The Clayton Air Compressors. Catalogue No. 10. The Clayton Air Compressor Works. 70 pages (6 by 9 inches; illustrated. This catalogue presents the complete line of air compressing machinery and accessories as manufactured by these builders. It contains illustrations, descriptions and lists of sizes of standard patterns, and illustrates descriptions of the Clayton type of compressors. It also includes tables and other data concerning compressed air transmission and losses by compressors operating at various altitudes. Air receivers, vacuum pumps, carbonic acid gas and high pressure compressors are also presented.

Westinghouse Electric & Manufacturing Co., Catalogues No. 222, direct-connected railway generators; No. 223, lightning arresters; No. 225, alternating current fan motors; No. 226, direct current fan motors; No. 228, polyphase motors. These catalogues are in pamphlet form and contain clear, concise descriptions with good engravings and plain directions for ordering. No. 228, which is devoted to Tesla polyphase induction motors, is specially worthy of attention because of the interest in and advantages of this type of motor. It has no brushes and no circuit connection with the armature which renders it specially well adapted for use in shops and exposed situations. This form is used at the Concord shops of the Boston & Maine Railroad, illustrated in our issue of April, 1898, page 114. We cannot imagine any power producing unit simpler than this form of motor. The reasons for its success are made clear by the description in this catalogue. This motor is particularly well adapted for railroad shops where expert attendance is not always available.

Car Heating Apparatus Catalogue for 1899 by the Safety Car Heating & Lighting Co., 160 Broadway, New York. This is a 54-page, standard size (8¼ by 10¾), illustrated pamphlet with large folded plates and sectional and detail drawings of the car heating equipment manufactured by this company. The standard and direct steam heating systems are fully described, including the car and locomotive equipment and the detail parts. The illustrations are from drawings and indicate an unusual amount of care to secure clearness, especially those illustrating the small details such as valves, jackets, couplers and fittings. A valuable feature is an appendix giving a record of forms of apparatus that have been superseded by improved devices. The catalogue gives evidence of a desire to enable the system to be thoroughly understood. It is successful in this and is also convenient. The parts are numbered for ordering and an index of the contents is provided. The paper and printing are excellent. Every officer who has to do with car heating should procure a copy.

Russell Snow-Plows and Flangers.—The 1899 catalogue of the Russell Snow-Plow Company contains illustrated descriptions of this well-known line of plows and flangers together with several half-tone reproductions of photographs showing the disastrous consequences of neglecting the provision of efficient snow removers. During the past year the company has had more orders than could be filled. The catalogue closes with the following paragraph: "We guarantee the Russell snow-plows to be better than any other plows or machines to clear railroad tracks of ordinary, hard or deep snow and to be much the best devices, if not the only ones, with which serious delays or blockades may be prevented during severe snow storms." The records made by these plows and printed in the pamphlet should be read by those who were responsible for the serious delays by snow blockades during the past winter.

Catalogue No. 6. Chicago Pneumatic Tool Co. This is a 6 by 9 inch illustrated pamphlet of 100 pages and is the most complete issued by this company. The engravings are half-tones from retouched photographs, showing the various pneumatic tools and appliances at work and the variety of uses to which they are put. The pamphlet also includes engravings showing the parts of each of the principal tools with numbers, for convenience in ordering.

Premium Plan of Paying for Labor. The "American Machinist" has found sufficient interest in the subject of the premium plan for paying for labor to necessitate reprinting in pamphlet form a recent article by Mr. F. A. Halsey, giving results of experience and a discussion of the principles involved. The "American Machinist" will send copies of the pamphlet free to

Dixon's No. 635 graphite, for lubricating gas engine cylinders, is strongly endorsed by quotations from letters written by engineers and others which are printed in a leaflet recently received from the Dixon people. The graphite is considered indispensable for gas engine cylinder lubrication, and its use, mixed with oil, is recommended for general lubrication.

EQUIPMENT AND MANUFACTURING NOTES.

A strong endorsement of the new semaphore glasses perfected and manufactured by Mr. John C. Baird, 83 Franklin St., Boston, has been received in the form of a letter from Mr. J. P. Coleman, Assistant Engineer of the Union Switch & Signal Co., to Mr. Baird, from which the following is quoted: "Your solid Nels signal red glass is an innovation in this field, as I have always understood that the veneering process of applying the red to one side of a clear glass was the only way of producing glasses serviceable for red signal lights. My attention was some time ago called to a lens thus colored from which the veneering had cracked off and a white light displayed when a red one was intended. Your method should prevent such conditions, which are vital, when white constitutes a safety light. I believe it is to you the credit of having first introduced a yellow glass of serviceable quality for distant signals is due, and its introduction on the N. Y., N. H. & H. RR., and here at the Boston Southern Station, has given ample opportunity for demonstrating its practicability. The excellence of your Nels signal green is beyond any question. I am especially interested in the development, inaugurated on the New Haven System by Mr. C. Peter Clark, of using red for danger, green for safety and yellow for caution, and I see no reason for questioning the color produced by your yellow disk at 2,000 ft. under the worst atmospheric conditions, and this to my mind is an ample distance through which any distant signal light need be visible at any time. I hope for the early arrival of the day when white lights will have been abolished entirely from the field of light signals."

A substitute for red and white lead and similar preparations for steam, gas and other pipe joints, was brought prominently before the recent convention because of its use in connection with the steam and air piping of the exhibits. This material is known as "Gumbo Cement," and is manufactured by the Gumbo Cement Co., 161 Lake St., Chicago, Ills. It is a mineral product in the form of a powder and is prepared for use by mixing with boiled linseed oil. Strong claims are made for its effectiveness in making tight and durable joints, which, however, may be easily taken apart at any time because of the freedom from corrosion. It is said to preserve rubber and other gaskets. A few sharp taps from a hammer are said to loosen the joint so that it may be unscrewed. It appears to be adaptable to many joints about locomotive boilers, boiler fittings, piping, front ends and tenders. For air pipe joints the cement is mixed with varnish or with boiled linseed oil and Japan dryer. When used for stopping leaks it is mixed in the same manner as for air pipes and it will harden in from 30 to 45 minutes. This cement has been used for nearly four years. The manufacturers report that it is now regularly ordered by the Standard Oil Co., the Pullman Palace Car Co. and over 100 railroads.

A significant fact concerning the demand for the W. Dewees Wood Company's patent planished jacket iron for locomotive use is that it has been practically coincident with the growth of the transportation interests of this country. Years ago, before the late Mr. Wood invented his planished iron, the American locomotive builders used Russia iron jackets, recognizing their economy and general desirability above painted jackets used by European roads. But the advent of Wood's jacket iron gave America a jacket superior to Russia iron at a much lower cost; and, of course, its adoption was only logical. Some American railroad systems use painted iron jackets, but the majority of these use jackets of Wood's planished iron for all passenger engines. It would appear that no two roads using painted jackets agree on the question of their economy. The European painted locomotive jacket is heavier and much more expensively finished than is any similar American one; but yet, as between European painted jackets and those made of Wood's planished iron there is no question as to the handsomer appearance, lower first cost and general economy of the American product.

During an inspection of brasses at the works of the Ajax Metal Company, recently, out of 3,200 brasses only one-half of one per cent. showed discoloration from heating. This is a remarkable record.

The Norwood side bearing for freight and passenger cars which was exhibited at the Old Point Comfort convention, attracted a great deal of attention on account of the model whereby the relative frictional resistance of it and an ordinary side bearing were comparable. The Norwood bearing uses four 1½-inch very hard tool steel balls with a pair of castings so arranged as to form seats for the balls. The upper seat is in two parts, the lower of which is slotted to a length sufficient for the maximum travel, and cut out to such a width as to allow the balls to project through the slot and bear against the lower plate on the truck bolster, when the side bearings are closed together. This slot is sufficiently narrow, however, to lift the balls from the lower seat when the bearings are separated. The slot is made widest at the center in order to insure the return of the balls to the center of the travel by gravity when the side bearings are separated. The suspension of the balls, free side movement and keeping them central by gravity are claims that are strongly urged by the Baltimore Ball Bearing Co., the manufacturers. It is claimed that the balls will not wear flat. Better side bearings are needed, as has frequently been stated in these columns, and this one should have a good trial because it promises well.

The Bullock Electric Manufacturing Co., of Cincinnati, O., are experiencing the practical results of prosperous times coupled with a record for high grade electrical machinery. Their new factory, with treble the capacity of their former works, and with new tools being added almost daily, is severely taxed to supply promptly the machines called for by its sales department. This difficulty, however, will soon be obviated by increased facilities. Numerous special machine tools, which have been delayed by the crowded condition of the maker's factories, are soon to arrive, and with these in operation, it will be possible to deliver more promptly. The type "N" Bullock slow speed motor, so admirably adapted to the driving of machine tools and other machinery by direct connection, is receiving much deserved attention from consulting and contracting engineers both at home and abroad.

Diamond Steel Emery.—A pamphlet has been received from the Pittsburgh Crushed Steel Co., of Pittsburgh, Pa., presenting the advantages of crushed steel abrasive as compared with emery and other abrasives. This crushed steel abrasive is exceedingly hard and sharp. It cuts but does not break in use, which renders it durable and very effective as will be seen by the testimony of mechanical officers of railroads who are using it. Samples of six sizes, sufficient for a convincing test, will be furnished upon application. A representative of the American Engineer has witnessed experiments with this abrasive upon which we endorse it heartily.

The Pneumatic Supply & Equipment Co., of New York, recently organized to install complete compressed air plants, have received an order for three duplex Corliss air compressors for the Tubular Despatch Co., the owners and operators of the pneumatic mail transmission tubes in New York City. These three compressors are to be located in the sub-basement of the Metropolitan Life Insurance Building, New York. The capacity of each compressor is in excess of 1,300 cubic feet of free air per minute, and the entire cost of the installation is stated to be over $12,000.

Rubber Mats, Matting and Treads as manufactured expressly for railroads are described in a small folder by the Boston Belting Co. These mats are low in price, attractive in appearance and durable. The style used by the Chicago & North Western Ry. for cars have the initials of the road in the center panel. The car step treads are made to conform to the shape of the steps and initials are placed in panels of these also when desired. The pamphlet illustrates the corrugated matting used by the Illinois Central for the floors of car vestibules, the initials of the road being in white letters. The durability of the matting is said to be equal to its attractiveness.

Keasbey & Mattison's magnesia lagging was specified for use on the boilers and cylinders of the freight locomotives built by the Schenectady Locomotive Works for the Midland Railway (England) and illustrated elsewhere in this issue.

The Chicago Pneumatic Tool Co. has arranged with the National Pneumatic Tool Company to sell the entire output of their factory, in connection with the pneumatic tools now handled by the Chicago company. This gives the Chicago Pneumatic Tool Company control of the sales of the Phoenix rotary drills, the new Haeseler piston drills and the appliances manufactured by the National Pneumatic Tool Company, as well as the Boyer riveters, hammers and piston air drills.

The International Correspondence Schools of Scranton, Pa., evidently intend to maintain their rights in their copyrighted instruction papers and pamphlets, clear evidence of this being seen in a circular just received from The Colliery Engineer Co., containing an account of recent litigation against the United Correspondence Schools and others for infringement. This circular contains the decision of Judge Lacombe and constitutes a caution to those who may be tempted to make improper use of the copyrighted papers of the International Correspondence Schools.

The Chicago Pneumatic Tool Co. has sent two expert operators of pneumatic riveters from the works of the Chicago Ship Building Co. to England and Scotland for the purpose of exhibiting the possibilities of pneumatic riveting in the ship yards there. The results which will be shown will probably be astonishing when compared with the methods in use in those yards and the export business, which is already large, is expected to greatly increase in consequence.

Edward Robinson, proprietor of the Wells Light, 44 and 46 Washington St., New York, recently returned from England after a very pleasant trip, taken partly in the interest of the Wells Light business and partly for pleasure. During his absence abroad 1,500 of the now famous Wells lights were sold to the Russian Government for use upon railroads in that country.

The International Correspondence Schools of Scranton, Pa., have secured the conviction of James F. Miller, representative of the "American Correspondence Schools," of Boston, in the Supreme Court of Erie County, New York, for slander in statements made by him reflecting on the integrity of the International Correspondence Schools. The jury awarded $350 damages and placed the costs on the defendant.

Mr. E. P. Bigelow has been appointed General Eastern Agent of the American Steel Foundry Co., with offices in the Havemeyer Building, New York.

The Siberian Railway has an appropriation of $8,497,500 for expenditure during the current year for improvements in the form of new rails and facilities for increasing the speed of trains. According to the London "Times," the increase of the traffic on the eastern and still more on the western section of the Siberian Railway has surpassed all expectation. Its construction was originally planned on economical lines, but the pessimist forecast of little or no movement for some years to come are being falsified by the facts. Consequently, the light rails, which are only 54 pounds, instead of 72 pounds, to the yard, will have to be be changed. Everything was calculated for not more than three pairs of trains per 24 hours, whereas there are already eight pairs, besides the bi-weekly express from Moscow to Krasnovodsk. The last year's traffic returns of the western Siberian section show 350,000 passengers, nearly 490,000 tons of goods, and 400,000 peasant emigrants. Last winter, although 600 new trucks were added and 1,600 old ones borrowed, there was an accumulation of 7,000 truck loads of goods for which no means of transport could be found. Of the 490,000 tons carried over the railway in 1898, more than 320,000 tons consisted of cereals. In the course of the next five years, it is expected that the carriage of wheat here will reach over 800,000 tons per annum. In the Altai mining district alone at the present moment there is a surplus of 355,000 tons of wheat, while in Central Russia whole populations are suffering from actual famine.

MASTER CAR BUILDERS' ASSOCIATION.
THIRTY-THIRD ANNUAL CONVENTION.

ABSTRACTS OF REPORTS.

Trains Parting.

Committee—G. N. Dow, John Hodge, D. Hawksworth, J. M. Holt.

Our circular of inquiry was sent out to 189 roads, representing 1,252,219 cars. Replies were received from 8 roads, representing 130,074 cars, or 4.23 per cent. of the roads and 10.38 per cent. of the cars represented in the Master Car Builders' Association. The roads whom we have to thank for furnishing the committee with information for a report are as follows: Chicago & West Michigan, Northern Pacific, Burlington & Missouri River, Michigan Central, Lake Shore & Michigan Southern, New York, Ontario & Western, Chicago, Milwaukee & St. Paul, and Atchison, Topeka & Santa Fe.

Seven roads reported 2,606 cases of trains parting between December 1, 1898, and April 1, 1899. [These reports are then analyzed in detail by the committee.—Ed.]

Cause for trains parting that were equipped with M. C. B. couplers in detail for 1,506 cases, as follows:

1.	Defective locks	263 cases, or	17.46 per cent.
2.	Worn knuckles	197 cases, or	13.08 per cent.
3.	Defective uncoupler attachment	84 cases, or	5.58 per cent.
4.	Broken coupler body	120 cases, or	7.97 per cent.
5.	Defective draft rigging	147 cases, or	9.76 per cent.
6.	Broken knuckles	208 cases, or	13.81 per cent.
7.	Miscellaneous causes	487 cases, or	32.34 per cent.

In view of the information obtained in the report, your committee would respectfully submit the following recommendations:

Maintaining spindles not less than 2 inches diameter, and keys not less than ½ by 2 inches. Also more care to be used in making pockets, avoiding sharp corners on rear end of pocket.

In the inspection of cars a close inspection to be made of knuckles and locks, with view of reducing unnecessary play in knuckles and locks.

The committee believes that it is necessary to make a systematic inspection of couplers in service, with a view of limiting the variation from the M. C. B. contour line, using a special gauge for the purpose. So far the committee has had but one gauge presented to it for consideration, sketch of which accompanies this report.

Committee would recommend M. C. B. buffer blocks on all cars to relieve the shock to draft rigging in slacking up, thereby reducing to a minimum break-in-twos induced from such causes. (Mr. Hodge excepted.)

Compensation for Car Repairs Done West of the 105th Meridian.

Committee—J. N. Barr, S. P. Bush, J. H. McConnell, L. C. Haynes, T. B. Kirby.

Note.—Mr. McConnell did not sign the report.

Considerable information as to the actual cost of the different materials used in the repairs of cars in interchange has been obtained, which shows, in addition to the cost of the different items, the recommendations of the different roads as to what percentage should be added to the present M. C. B. prices for repairs west of the 105th meridian, also the mileage made by cars on foreign roads and the mileage of foreign cars on each road reporting. The amount collected and paid for mileage and the amount collected and paid for repairs of cars under the Rules of Interchange. The roads reporting are arranged on the statement in four groups. The first group includes lines entirely or largely west of the 105th meridian. The second group includes lines both east and west of the 105th meridian. The third group includes lines which lie between Buffalo and Omaha. The fourth group includes roads entirely or largely east of the meridian of Buffalo.

Your committee also attaches statement (No. 2) copied from the Interstate Commerce Commission's Ninth Annual Report for the year ending June 30, 1896, showing the freight earnings per ton per mile for lines over 250 miles long wholly or nearly west of the 105th meridian, and for fifty representative roads east of the 105th meridian. It is the opinion of your committee that this information should be taken into consideration in discussing this question.

In taking up the question as to differentials in compensation for car repairs made under the Rules of Interchange west of the 105th meridian, the most important consideration, next to the individual prices for the different items, is, as shown on the statement, the amount paid annually to foreign lines in interchange and the amount collected annually from foreign lines for repairs to cars. In case the two amounts should be equal, there would be no occasion for any further consideration of the question. For example: If the roads west of the 105th meridian should pay foreign roads $20,000 for the repairs of their cars, and should collect from other roads $20,000 for repairs of foreign cars, the difference in the cost of doing the work as compared with M. C. B. prices would not be any advantage or disadvantage to the parties concerned. The statement, however, shows that the western lines collect more for repairs than they pay, and on account of this difference there is a loss to

these lines as compared with the other lines in the United States.

It is the loss on this portion of the amount of repairs for which undoubtedly the western lines ask relief. In order to secure such relief, they ask that they be allowed to charge other roads a certain percentage above the established M. C. B. prices. In other words, they ask for a differential in cost of repairs made west of the 105th meridian. In taking a broad view of the subject, the third group of roads should ask for a corresponding differential in their favor, as against the fourth group of roads as shown in statement No. 1. The same applies to the various other groups shown on the statement, and in order to be strictly equitable in arranging prices, there should be a differential between a number of different roads in the same group. For example, the C. & O. R. R. pays 15 cents per hour for repairs to cars, the Fitchburg R. R. pays 19 cents. The C. & O. R. R., in making repairs, has the advantage of 4 cents per hour on labor as compared with the Fitchburg R. R. The same remarks apply to many of the items of material used in repairs. The statement certainly shows that this discrepancy is greater when we compare the roads in group No. 1 with any of the other roads shown in the statement, but this is a difference in degree. Your committee does not see its way clear to make a special recommendation in the case of the western roads without doing an injustice to many other sections of the country. The scarcity of labor and cost of transportation, together with other considerations, increases the cost of doing the repairs on cars on the western lines, but this variation exists to a greater or less degree as shown above. In view of the above mentioned scarcity of labor and cost of material, as well as other circumstances, the freight earnings per ton per mile on the ten roads west of the 105th meridian is shown to be a little more than 1 cent greater or more than 100 per cent above the average freight earnings per ton per mile for the entire United States. On the fifty roads east of the 105th meridian shown on the statement it is only 1/100 of a cent, or 1 2/10 per cent. above the average for the United States. By referring to the figures showing the amounts collected and paid for repairs to cars in interchange, it will be apparent to any one that this item is an excessively small amount as compared with the total cost of freight repairs on any road, and at the same time the advantage of 100 per cent. increase over the general average of the freight earnings of the United States runs into immense figures. Under these circumstances, it would be scarcely right for the roads west of the 105th meridian to ask the eastern lines to share a portion of the extremely small burden of cost of repairs on interchange cars.

As a question of more specific character, and bearing more intimately on the subject under discussion, it may be mentioned that the eastern roads furnish their cars to run over western lines and furnish them in some cases at a mileage cost to the western roads of less than it actually costs them to maintain their own cars. It is very possible, in view of this state of affairs, that roads west of the 105th meridian have three cars per mile of track, while roads east of the 105th meridian average over seven cars per mile. Of course, the mileage of foreign cars over western lines could be reduced by their increasing their equipment, but according to the figures this could only be done at a much greater loss than what is occasioned by paying mileage on foreign cars and doing the repairs at a lower figure than the actual cost. This same argument also applies to all roads in various sections of the country and is undoubtedly the reason why they are willing to submit to discrepancies in the cost of repairs, which might otherwise be a serious source of contention. Even if the above circumstances did not exist, it is a question as to whether it would be proper for the western roads to ask the other lines to share a portion of the burden which is forced upon them by reason of their location, and your committee is inclined to the opinion that the M. C. B. Association cannot take into consideration and endeavor to alleviate those unfortunate circumstances. Your committee is of the opinion that in the consideration of any change in cost, necessarily the mileage compensation should also be taken into consideration. If in our section of the country 6/10 of a cent per mile is sufficient remuneration for the use of a freight car and the present M. C. B. prices for repairs are based on such a figure, then any radical change in the cost of repairs, in justice necessitates a consideration of the cost of the mileage, as one seems to your committee to be inseparable from the other.

In conclusion, in view of the complexity of the differential question, of the variation in remuneration and cost of repairs, which varies in all sections of the country, your committee feels that it cannot recommend any change in the established policy of uniform prices for all parts of the country.

M. C. B. Couplers.

Committee—W. W. Atterbury, W. P. Appleyard, W. S. Morris.

The subject as assigned to your committee was as follows: "M. C. B. Couplers: To define contour lines more fully when new and when worn, and propose specifications for couplers."

The topic may be divided into three parts: 1, to define the contour lines more fully when new; 2, to define the contour lines more fully when worn; 3, to propose specifications for couplers.

1. To define the contour lines more fully when new. This part of the subject can again be divided into four parts, none of which are covered by present M. C. B. standards: (A) To fix the length of the guard arm; (B) The vertical dimension of the knuckle; (C) The vertical dimension of the end of the guard arm, and, (D) To refer the axes upon which the contour lines are constructed to the axis of the shank of the coupler.

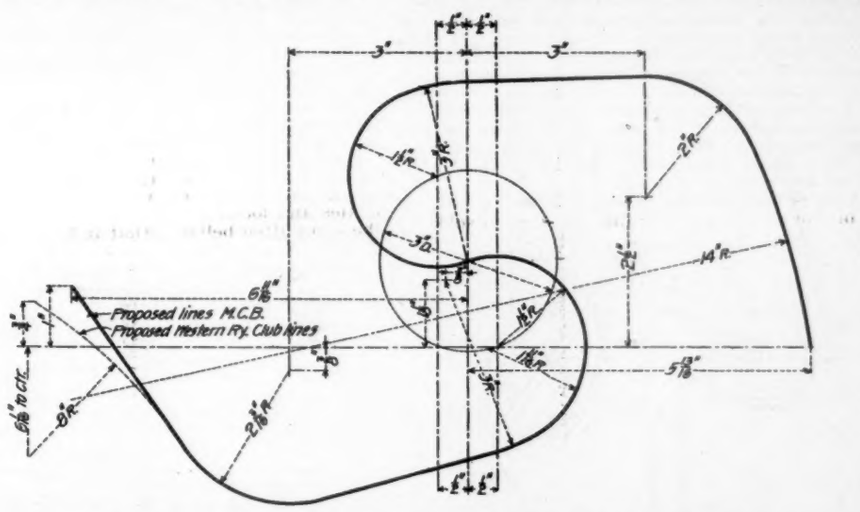


Fig. 1.—Proposed Modification of Contour Lines of M. C. B. Couplers.

(A) In regard to the length of the guard arm, it is recommended that the contour lines be extended about one inch beyond the point where they at present terminate, and that the M. C. B. Standard Limit Gauges for new couplers have the guard arm screw moved from its present position to a new one at the end of the proposed new contour lines. (B) It is recommended that the vertical dimension of knuckles be fixed at nine inches as a minimum. (C) It is recommended that the vertical dimension of the end of the guard arm be fixed at seven and one-half inches as a minimum. (D) It is recommended that the twist gauge for new couplers, shown in Fig. 11, be used so as to insure that the heads are neither twisted nor displaced sidewise with relation to the shank.

In addition to these matters relating strictly to the contour line, there are others that require attention: (E) It is recommended that the horizontal plane containing the axis of the shank of the coupler bisect the vertical dimensions of the knuckle and end of guard arm. (F) It is recommended that the gauge for new knuckles be used on all knuckles purchased separately for renewals. (G) It is recommended that the vertical height of the stop shoulder or horn of coupler be not less than three and one-half inches, and that the horn be arranged to touch the striking plate before the back of the head of the coupler strikes the ends of the draft timbers.

2. To define the contour lines more fully when worn. This takes in the subject of gauges for worn couplers, and it is recommended that the gauge shown in Fig. 41 be used. These gauges are cheaply made of sheet metal stampings, and it is earnestly recommended that they be immediately put into use at all interchange points, and that the same care be given to the examination of couplers as is given to any other portion of the car. We have no doubt the use of this gauge will put a stop to a large percentage of the instances of trains parting on the road without couplers unlocking.

3. To propose specifications for couplers. This part of the subject has received very careful consideration. It has been difficult to reconcile the diametrically opposite opinions which

have been expressed by various railroad men and manufacturers.

It is believed, however, that rigid specifications and tests will do much to weed out the poorer makes of couplers at present being furnished, and it is recommended that in the future all couplers be purchased subject to the provisions of the following standard specifications and tests.

SPECIFICATIONS.

After September 1, 1899, all M. C. B. automatic car couplers purchased by or used in the construction of cars for the above-named company must meet the requirements of the following specifications. [The important items are included.—Editor.]

Couplers must conform to M. C. B. contour lines, dimensions and gauges. They must couple and uncouple with each other (with either or both knuckles open) and with the master or sample coupler. They should unlock easily, and should lock with freedom when the knuckle is pushed in by hand. They must have complete locking fixtures.

They must have steel pivot pins 1½ or 1⅝ inches in diameter, and of a uniform length of 13½ inches from the under side of head to the center of pin hole for ⅝-inch cotter. Pivot pins, after being heated and having the head struck up, must be carefully and properly annealed.

Knuckles must conform closely to dimensions and fit neatly in coupler head, so that the contour will conform strictly to M. C. B. gauges. The coupling pin hole must not be less than 1 9/16 inch nor more than 1⅝ inch in diameter, and must be parallel with the face of knuckle and at right angles with the axis of the knuckle. The weight of the coupler complete to be not less than———lbs., and of bar without any of the attachments not less than———lbs. The minimum weight of each knuckle to be———lbs. As many drawbars and knuckles as possible must be cast from each heat of steel or melt of iron used. All parts to be well annealed throughout. Couplers and parts will be submitted to the following five distinct tests:

1. Striking test on closed knuckles of complete coupler. Coupler to be held in machine so that the axis of the coupler is in the center line of drop, and the axis of the coupling pin hole passes through the center lines of the legs of the machine and the shank of the coupler rests solidly on the anvil. Blows to strike directly on knuckle.

Three blows of 1,640 pounds weight falling 5 feet.

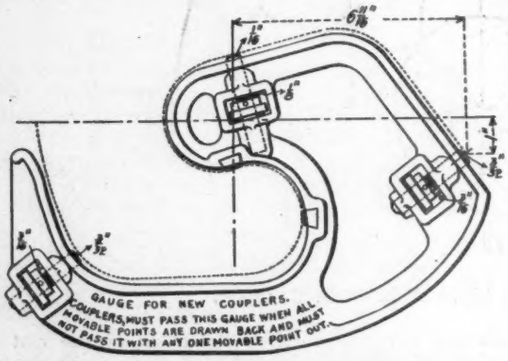

GAUGE FOR NEW COUPLERS.
COUPLERS MUST PASS THIS GAUGE WHEN ALL MOVABLE POINTS ARE DRAWN BACK AND MUST NOT PASS IT WITH ANY ONE MOVABLE POINT OUT.

Fig. 3.—New Gage for New Couplers.

Three blows of 1,640 pounds weight falling 10 feet.

A coupler will be considered as having failed to stand this test when it is broken before it has received three blows at 5 feet and three blows at 10 feet, or when any cracks appear more than 1 inch long or open more than 1/16 inch, or when the center line of the shank is distorted more than 1 inch from its original position, or when the knuckle is found to have closed more than ¾ inch from its original position when pulled out against the lock after having received the three blows at 5 feet.

2. Jerk test of complete couplers. Two couplers to be supported in the machine by the yoke forgings and draft springs provided. Blows to strike directly on the equalizer bar connecting the two couplers and resting on their closed knuckles.

Three blows of 1,640 pounds weight falling 5 feet.

Three blows of 1,640 pounds weight falling 10 feet.

A coupler will be considered as having failed to stand this test when it is broken before it has received three blows at 5 feet and three blows at 10 feet, or when any cracks appear more than 1 inch long or open more than 1/16 inch, or when the knuckle has opened more than ½ inch from its original position or so that the equalizer bar will not stay in place when struck.

3. Pulling test for complete couplers. Two couplers to be supported in the pulling machine by yoke forgings, to be locked together as in the running position, with their axles in the same straight line. Couplers to stand a steady pull of 120,000 pounds if fitted with steel knuckle and 85,000 pounds if fitted with wrought-iron knuckle. A coupler will be considered as having failed to stand this test when it is broken before it has been pulled the prescribed number of pounds, or when any cracks appear more than 1 inch long or open more than 1/16 inch, or when the knuckle is found to have opened more than ¾ inch from its original position when pulled out against the lock, or when the couplers slip apart in the pulling machine.

In case of the failure of any part of the complete coupler under tests 1, 2 and 3, those parts which may not have failed may be submitted for a future test, providing such parts shall not be condemned by the individual tests hereinafter specified.

4. Guard arm test of drawbar. Drawbar to be held vertically in machine so that the edge of guard arm is in the line connecting the centers of the legs of the machine, and so that the shank rests solidly on the anvil. Blows to strike directly on the edge of the guard arm.

For Malleable Iron Couplers.

Three blows of 1,640 pounds weight falling 3 feet.

Two blows of 1,640 pounds weight falling 5 feet.

For Steel Couplers.

Three blows of 1,640 pounds weight falling 3 feet.

Four blows of 1,640 pounds weight falling 5 feet.

A drawbar will be considered as having failed to stand this test when it is broken before it has received the prescribed number of blows, or when any cracks appear more than 1 inch long or open more than 1/16 inch, or when the center line of shank is distorted more than 1 inch from its original position, or when the head is distorted sufficiently to allow the hammer to hit on the face of the bar, or the lugs of the bar to strike against the hammer.

5. Separate knuckle test.

Knuckle to be laid horizontally on one of its lugs, upon a solid anvil, and given the following blows upon the top of one lug:

Knuckles pivoted 2 inches or less from center of pivot pin hole to face of knuckle to stand—

Three blows of 1,640 pounds weight falling 3 feet.

One blow of 1,640 pounds weight falling 4 feet.

Knuckle pivoted 3 inches or less from center of pivot pin hole to face of knuckle to stand—

Three blows of 1,640 pounds weight falling 3 feet.

Two blows of 1,640 pounds weight falling 4 feet.

Knuckles pivoted over 3 inches from center of pivot pin hole to face of knuckle to stand—

Three blows of 1,640 pounds weight falling 3 feet.

Three blows of 1,640 pounds weight falling 4 feet.

A knuckle will be considered as having failed to stand this test when it is broken before receiving the proper number of blows, or when any cracks appear more than 1 inch long or open more than 1/16 inch.

At the end of all the above tests, except No. 5, couplers will be tried for disablement. Knuckles must open and locking devices be operative after the coupler has received the specified test.

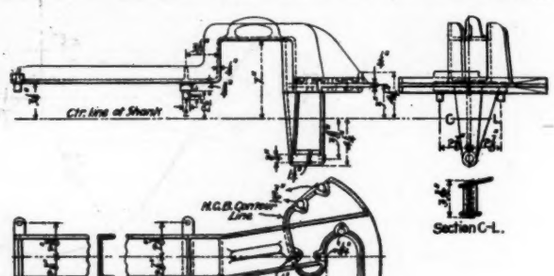


Fig. 11.—Twist Gage.

Before testing, couplers must have a row of center-punch marks put upon the center line of top of shank, so distortion can be detected.

General Considerations.

In addition to these matters pertaining strictly to its subject, the attention of the committee has been called to the fact that in some cases couplers with shanks of dimensions differing from the standards of the Association are being made and introduced in service. As this change will affect the standards of the Association and work possible hardship to other railroads in the way of interchange of cars, we call the attention of the Association to this, with a view that the subject of increased dimensions of the shank be referred to a committee for further investigation, and report what changes, if any, should in their judgment be made in present standards of the Association. It is also suggested that the back corners of the yoke in the pocket attachment be changed from ¼ inch radius to ⅝ inch radius. It is further suggested that the play of the shank of the coupler in the carry iron be not less than ½ inch on each side.

Another matter which has claimed considerable attention is a standing committee on couplers. It is recommended that such a committee be appointed, whose duty it shall be to test couplers submitted to them. A standing committee on coupler tests has been suggested from time to time, somewhat after the manner of the Standing Committee on Triple Valve Tests, and Brake Shoe Tests. There ought to be some way of certifying to the proper design and quality of so important an appliance as a coupler, and this committee would prove a very valuable addition to the others.

In conclusion, the situation in regard to the multiplicity of couplers and parts is brought to the serious attention of the Association. There should be some way of reducing the present uselessly extravagant manner in which repair parts for the

seventy-seven different kinds of couplers with their ninety-three different knuckles have to be carried at the hundreds of interchange and repair points throughout the country. For this reason it is recommended that pivot pins should be of one uniform length and of only two sizes. A pivot pin 1½ inches in diameter is small enough for use in a coupler, and by making one length sufficient for the coupler having the greatest distance over the lugs, it can easily be put into any coupler in which this distance is less. A commentary on the coupler situation is presented in Fig. 73, the Sargent Company's knuckle sheet. [Not reproduced.—Editor.] This multiplicity of repair parts should be done away with, and by a process of evolution,

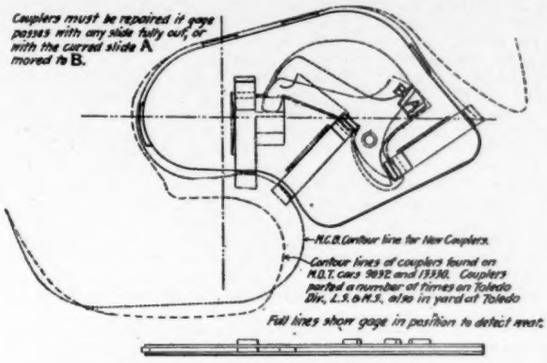

Couplers must be repaired if gage passes with any slide fully out, or with the curved slide A moved to B.
M.C.B. Contour line for New Couplers.
Contour lines of couplers found on M.C.B. cars 9092 and 13310. Couplers parted a number of times on Toledo Div., L.S. & M.S., also in yard at Toledo
Full lines show gage in position to detect wear.

Fig. 43.—Gage for Worn Couplers.

a few standard couplers should be retained, and these gradually introduced throughout the country as breakages make replacements necessary.

Extracts from Appendices.

The proposed contour line is shown in Fig. 1, and the old one in Fig. 2. It will be noted that the only change proposed is in the length of guard arm. The reverse curve of 8 inches radius has been straightened out and continued as a tangent to the arc drawn with the 2 3/16-inch radius. It is also rdeuced in flare so as to hold the couplers together better.

There is a limit to which the length of the guard arm may be extended, as after a certain point has been reached, any added length is not only useless but renders the part more liable to damage.

The axes on which the M. C. B. contour lines are laid down are not referred to the axis of the barrel or shank of the coupler. As a result, it may happen that the head of the coupler may be twisted with relation to the shank, so that the transverse axis or the vertical axis of the contour lines is

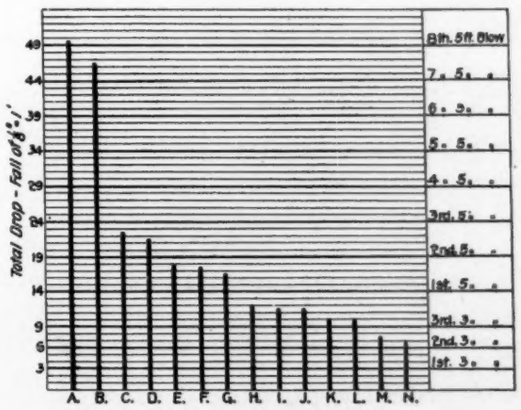


Fig. 64.—Cuard Arm Tests—Averages of Blows.

A Chicago.	*H Gould.*
B Munton.	*I Mo. Pac.*
C S. H. & H.	*J Buckeye.*
D Janney.	*K American.*
E Hien. Mal. I	*L Trojan.*
F Tower.	*M Standard.*
G Hien. Steel.	*N Lone Star.*

not normal to the longitudinal axis of the coupler as a whole. It may also happen that the whole head of the coupler is displaced bodily to the right or left of the center line.

To provide for these contingencies, the gauge shown in Fig. 11 is submitted. The body of the gauge is a duplicate of the M. C. B. gauge for new couplers, provided with the long guard arm, and the contour is the same as the M. C. B. gauge with all movable points drawn back. It is, therefore, sure to enter every coupler that has been properly inspected by the other gauge. The arm extending back over the shank is provided with hardened steel pins, one pair of which must drop down over the square part of the shank immediately behind the head, and the other pair over the block upon which the yoke is riveted. There is sufficient play between these pairs of points to allow manufacturers proper variations, but badly distorted castings are discovered when the pins interfere with the proper seating of the gauge.

It must be remembered that there are many points where wear may take place. They are as follows: 1 Heel of knuckle, where the coupler comes in contact with the guard arm of the opposing coupler. 2. Inside of guard arm. 3. Inside face of knuckle where pulling stress is greatest. 4. Rear side of pivot pin hole in knuckle. 5. Front side of pivot pin hole in lugs of drawbar. 6. Pivot pin. 7. Locking surface of tail of knuckle.

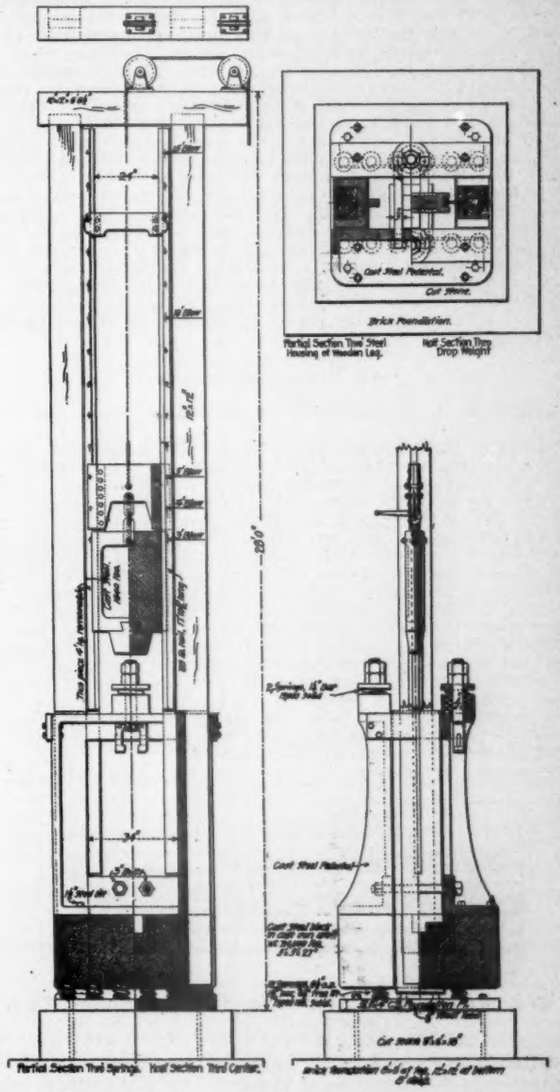


Fig. 68.—Proposed M. C. B. Drop Test Machine.

8. Surface of lock in contact with knuckle. 9. Surface of lock in contact with drawbar. 10. Drawbar where lock comes in contact with it.

The common and final result of all this wear is to so diminish the effective width of the knuckle and to so increase the space between the guard arm and the point of the knuckle of the opposing coupler that the couplers can slip past each other. This the gauge is designed to prevent by the action of the cam-shaped lever A, Fig. 41. When this is pushed over to the end of its curved slot it throws all the slides part way out. Experience seems to indicate that the distance from guard arm to point of knuckle should not be greater than 5¼ inches and this is the dimension used in the gauge.

In Fig. 63 are plotted the result of the behavior of a large number of couplers under the guard arm drop test. A large majority of these—69 per cent., in fact—broke before they had received three blows at 3 feet, and two blows at 5 feet. These couplers were taken out of regular shipments to fill orders, and in regular course would have gone out on the road. In regard to the policy of putting on cars couplers whose heads break off on the first blow at three feet, there is nothing to be said. The statement of the fact is a commentary.

Fig. 64 shows graphically the result of some of these tests. Each vertical scale division shows a fall of drop of one foot,

so that the average of the total blows the coupler received can be ascertained by an inspection of this figure. Three blows at 3 feet were given first, and then the 5-foot blows. The total fall of the drop in feet is shown by the length of the line.

The construction of a standard drop testing machine has long been urged and the accompanying drawings are submitted as embodying a satisfactory design. In the first place, the machine must be reproducible. A machine built on rock foundation should give just the same results as one built on soft soil. To this end it has seemed indispensable that the anvil should be spring supported. As strong and rigid a foundation as can be built must be put down, and the capstone covered with a cast-steel bed plate, having recesses cored in it to receive the steel housings for the legs of the machine. The 15-foot blows will be abandoned, as all the testing necessary can be done with the 10-foot blows, and the 15-foot blows have been found to be too destructive to the auxiliary apparatus in jerk tests, yoke forgings and equalizer bars breaking when submitted to these severe shocks. Besides that, it seems to be difficult to get couplers to stand even 10-foot blows, so that 15-foot blows may be left out of the question entirely. The anvil is made heavy enough to absorb in itself all blows and is supported on springs which are wound on definite sizes of mandrels, and from steel to fulfill definite specifications. The uprights to support the brackets carrying the yoke attachment for jerk test are bolted down to the anvil, and leave plenty of room for the latter to rise and fall easily. The machine is accessible in the highest degree, and couplers can be easily and quickly put in and taken out in all tests. By the use of steel blocking and wedges, all couplers are held firmly in drop tests, and all are put on the same basis. It is believed that this machine can be built anywhere, and couplers tested on it are sure of receiving the same treatment as others tested in a different place.

Air Brake Appliances.

Committee—A. L. Humphrey, A. M. Parent, H. C. McCarty.

Replies to the circular received would indicate that the prevailing opinion among a large majority of the members was that the location of cylinder and triple valves should be so arranged as to make them easy of access for the repair men; however, from the plans submitted and the design generally adopted throughout the country, it would indicate that their desire was not to make this question the paramount consideration, thereby sacrificing the efficiency of the brake, but to take both into consideration. Your committee has, therefore, endeavored to locate a line of consistency between the two extreme ideas, one side appearing to favor the idea that the cylinders should be located entirely with a view of making it more convenient and less hazardous for the repair men; while the others think the location of the cylinders should be determined entirely by the design of truck and body leverage used, so as to get as straight a pull on the rods as possible, regardless of the repairs necessary to be made from time to time. We would therefore respectfully recommend:

The adoption for clear bottom cars, for the location of the

Fig. 3.—Proposed Standard Piping for Clear Bottom Cars.

air cylinder and triple valve, between the needle beams, with a clearance of not less than 12 inches between the needle beams and the end of the cylinder head, and located about 20 inches from center of car to center of cylinder, longitudinally, the exact position of which will, to a certain degree, have to be determined by the local conditions. This position renders it convenient for cleaning and repairing, and at the same time makes it possible to arrange a very convenient system of leverage.

Cars not having clear bottoms, as hoppers and center-dump gondolas, should have the cylinders located on the side of the car, as near the inside of the side sills as the design of the car will permit. This will avoid the danger incident to the repairs of cylinders and triple valves located at the end of the hoppers.

The committee would recommend for standard design of piping for clear-bottom cars design as shown in Fig. 3, in which we have endeavored to do away, as far as practicable, with all screw joints, substituting pipes with bends of as great a radius as possible. The location of the pipe hangers at the ends of cars when applied to the end sill is considered as contributing largely to the trouble experienced in loose pipes, and it is recommended that the hanger be attached to one of the longitudinal sills.

It is recommended that the location of the main air pipe at the ends of cars be determined by a horizontal measurement (of 13 inches) from the center line of the shank of the drawbar to the center line of pipe, and also a measurement (of 13 inches) from the inside face of the M. C. B. knuckle to the center of the plug of angle cock.

With regard to substitution of bends of long radius in cars not having clear bottoms, more difficulty will be experienced than with the clear-bottom car.

The committee has been especially impressed with the insecure manner in vogue of fastening the air cylinders, reservoirs, retaining valves, pipes, etc., to the framework, and would therefore recommend that the bolts fastening the cylinders and reservoirs be either double nutted or cottered, so as to prevent same from working loose, and that the air pipes be securely fastened to the framework of the cars with a liberal number of clamps. The application and care of retaining valves has, in the opinion of your committee, been badly neglected.

Your committee desiring an expression regarding the use of what is known as the dummy coupler, asked in its circular whether or not it had been discarded, to which those representing about half the number of cars replied that they had discarded same and believed that its use was a detriment rather than a benefit. This leaves a small majority in favor of the use of the dummy coupler, and it is the opinion of your committee that if a coupler could be devised which would work automatically so that it would not be necessary for an operator to use it, that such a device would be of undoubted advantage.

In the circular of inquiry the committee asked the following question: "As we believe exact conformity to the Westinghouse recommended air brake practice, as shown by their charts, is an unusual thing rather than a common practice, please express your views as to the advisability of adopting the Westinghouse recommended practice, with such modifications as a committee of this Association, working in co-operation with the Westinghouse Company's representatives, might agree upon."

Replies to this question were practically unanimous, and indicated that the representatives replying considered the Westinghouse recommended practice was the proper thing, with such modifications as a committee appointed by this Association in co-operation with representatives of the air brake company might agree upon. Your committee would, therefore, recommend that another committee be appointed to confer with the representatives of the air brake company, with a view of making a further report of their conclusions and what they would recommend.

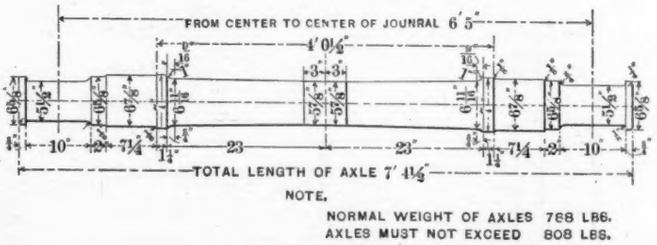
Wheels and Axles: Specifications for Wheels and Axles for 60,000, 80,000 and 100,000 Pound Cars.

Committee—E. D. Nelson, Wm. Garstang, J. J. Hennessey.

A report was made to this Association and read at the Convention of 1897, on "Specifications for Cast-Iron Wheels." This report brought forth some discussion, but its recommendations were not submitted to letter ballot, and therefore not adopted by the Association.

Your committee has gone over the report of 1897, and has concluded that it cannot do better than to present the same report with some minor changes. These changes are as follows:

First.—To include only 33-inch wheels, because this diameter


FROM CENTER TO CENTER OF JOURNAL 6' 5"
TOTAL LENGTH OF AXLE 7' 4¼"
NOTE.
NORMAL WEIGHT OF AXLES 768 LBS.
AXLES MUST NOT EXCEED 808 LBS.

Axle for 100,000-Pound Cars.

has become universal for cars of 60,000, 80,000 and 100,000 pounds capacity.

Second.—For the drop test where the wheel is struck centrally on the hub, it is recommended that the wheel must stand ten blows instead of five of a 140-pound weight falling twelve feet.

Third.—For the drop test where the wheel is struck on the plate, close to the rim, your committee has added wheels of 625 pounds and 650 pounds.

Fourth.—The form for the face of the weight used in the drop tests is specified.

Fifth.—The thermal test is made compulsory with either the drop test on hub or drop test on plate.

Axles.

At the convention of 1898 a voluntary report was made to the Association recommending a design for an axle for cars of 100,000 pounds capacity. [The substance of this report was printed in our issue of September, 1898, page 299.—Editor.] Your committee presents with this report a design for such an axle, it being the same as referred to in the report mentioned.

Concerning specifications for axles, your committee has gone over those contained in the report of a Committee on Axle for Cars of 80,000 Pounds Capacity, made in 1896, and would submit the following revised specifications:

[From the complete specifications we reproduce the following paragraphs.—Editor.]:

Specifications for Steel Axles.

All axles must be made of steel, and the material desired have the following composition:

Carbon	0.40 per cent.
Manganese, not above	0.50 per cent.
Silicon	0.05 per cent.
Phosphorus, not above	0.05 per cent.
Sulphur, not above	0.04 per cent.

All axles will be tested physically by drop test. The testing machine must conform in its essential parts to drawings which will be furnished by the..... R. R. Co. These essential parts are: the points of supports on which the axle rests during tests must be three feet apart from center to center; the tup must weigh 1,640 pounds; the anvil, which is supported on springs, must weigh 17,500 pounds; it must be free to move in a vertical direction; the springs upon which it rests must be twelve in number, of the kind described on drawing; and the radius of supports and of the striking face on the tup in the direction of the axis of the axle must be five (5) inches. When an axle is tested it must be so placed in the machine that the tup will strike it midway between the ends, and it must be turned over after the first and third blows, and when required, after the fifth blow. After the first blow, the deflection of the axle under test will be measured in the manner specified below.

It is desired that the axles, when tested under the drop test as specified above, shall stand the number of blows at the height specified in the following table without rupture and without exceeding as the result of the first blow the deflections given:

Axle.	No. Blows.	Height of Drop.	Deflection.
M. C. B. 4¼ by 8 inch journals for 60,000-lb. cars....	5	34 feet.	7 inches.
M. C. B. 5 by 9 inch journals for 80,000-lb. cars....	5	43 feet.	6 inches.
M. C. B. 5½ by 10 inch journals for 100,000-lb. cars...	7	43 feet.	4½ inches.

Axles will be considered as having failed on physical test and will be rejected if they rupture or fracture in any way, or if the deflection resulting from the first blow exceeds the following:

M. C. B. axle, 4¼ by 8 inch journals	8 inches.
M. C. B. axle, 5 by 9 inch journals	7 inches.
M. C. B. axle, 5½ by 10 inch journals	5½ inches.

Axles will be considered to have failed on chemical test and will be rejected if the analysis of the borings taken as above described gives figures for the various constituents below, outside the following limits, namely:

Carbon	below 0.35 per cent., or above 0.50 per cent
Manganese	above 0.60 per cent.
Phosphorus	above 0.07 per cent.

In order to measure the deflection, prepare a straightedge as long as the axle by reinforcing it on one side, equally at each end, so that when it is laid on the axle the reinforced parts will rest on the collars of the axle, and the balance of the straightedge not touch the axle in any place. Next place the axle in position for test, lay the straightedge on it, and measure the distance from the straightedge to the axle at the middle point of the latter. Then, after the first blow, place the straightedge on the now bent axle in the same manner as before, and measure the distance from it to that side of the axle next to the straightedge at the point farthest away from the latter. The difference of the two measurements is the deflection.

As the Master Car Builders' Association now has adopted, as standard, three axles, it is recommended for the purpose of identifying these more readily that they be designated by numbers, as follows:

M. C. B. No. 1	Axle with journals 3½ by 7 inches.
M. C. B. No. 2	Axle with journals 4¼ by 8 inches.
M. C. B. No. 3	Axle with journals 5 by 9 inches.
M. C. B. No. 4	Axle with journals 5½ by 10 inches.

Uniformity of Section for Car Sills.

Committee—R. P. C. Sanderson, J. S. Lentz, N. Frey.

The two principal purposes which your committee aimed to accomplish were:

First, to recommend such sizes of sills as would be suitable for general use in the design and construction of all new flat-bottomed cars having timber sills, trusting that, if adopted, the loyalty of the members would induce them to prefer these sizes to any others in all new work hereafter.

Second, to choose such sizes that would be most generally suitable for the repairs of the great majority of the cars now in service.

In preparing the circular of inquiry your committee did not think it advisable to consider any cars below 50,000 pounds capacity, less than 32 feet in length, or of special construction. It is gratifying to note the very general interest taken in the subject by the members, as is shown by the large number of responses received, and your committee feels that the field has been well covered. The railroads that have replied to your committee's circular represent a total of 853,014 cars of 50,000 pounds capacity and over, out of a total of 1,252,219 cars.

The information has been condensed and tabulated in the tables which follow, one for box, stock, flat and gondola cars over 32 feet and under 40 feet in length, and of 50,000 pounds capacity or over; the other table covers only cars of 40 feet or over in length, mostly furniture cars or long gondolas.

The thickness and depth of sills given in the tables are finished sizes, and the figures in the table represent the aggregate number of cars reported as having sills of the given sizes. For instance, by referring to the table for cars over 32 feet and under 40 feet, it will be seen that for sills having a thickness of .5 inches and a depth of 8 inches there are 105,259 cars in service. As the result of the study of these tables your committee feels justified in recommending the following finished sizes for sections of longitudinal car sills:

For cars such as box, stock, flat, long gondolas, refrigerators, etc., 32 ft. and over in length, but under 40 ft.:

4 by 8 inches.	4 by 9 inches.	4 by 10 inches.	4½ by 12 inches.
4½ by 8 inches.	4½ by 9 inches.	4½ by 10 inches.	5 by 12 inches.
5 by 8 inches.	5 by 9 inches.	5 by 10 inches.	5 by 14 inches.

For cars 40 feet long and over, such as furniture and special long gondolas:

4½ by 8 inches.	4½ by 9 inches.	6 by 9 inches.	6 by 12 inches.
5 by 8 inches.	5 by 9 inches.	6 by 10 inches.	6 by 14 inches.
	5 by 10 inches.		

It is believed that the above recommendations afford a sufficient range of sizes to cover all requirements of design; they are good merchantable sizes, and if adopted and used as suggested, we may expect that car repairs will be greatly expedited, as there will be less delay in getting special sizes of lumber, and we will be able to get our requisitions for regular sizes filled more promptly, as the lumbermen can saw in advance of orders with a reasonable certainty of selling their stock.

To further expedite the general introduction of standard sizes for car sills to facilitate car repairs, and reduce stocks of lumber, your committee further recommends that the following paragraph be introduced into the Master Car Builders' Rules of Interchange, to follow Section 3 of Rule 4:

"When renewing long sills in foreign cars requiring odd sizes of lumber, the next larger suitable M. C. B. standard size of sill may be used and considered as proper repairs."

Height of Couplers.

Committee—S. Higgins, J. H. McConnell, C. M. Mendenhall.

The Committee on Height of Couplers, appointed at a meeting of the Executive Committee held in Saratoga last June, has decided not to confer with the American Railway Association and the Interstate Commerce Commission, to get the limits of height of couplers changed to 31 inches minimum, and 35 inches maximum. The investigation made by the committee has satisfied the members of the committee that any increase in the present limits is not advisable at this time.

With knuckles divided in the center by the slot for coupling link, any increase in the limits for height of couplers will result, in many cases, of only one knuckle lug of each coupler being in contact. Any increase in the limits of height of couplers will tend toward a greater number of trains parting, due to one coupler passing over the other. The committee's decision is based on these two facts.

For some time to come there will be a number of link-and-pin couplers in service, and for this reason it is not advisable to make any recommendations toward closing the slot in the knuckle.

The committee thinks that after January 1, 1900, will be time enough for the Master Car Builders' Association to take up the matter with the view to closing the slot in the knuckle, and at that time any increase in the limits for height of couplers should be considered.

Supervision of Standards and Recommended Practice of the Association.

Committee—A. M. Waitt, G. L. Potter, Wm. Apps.

The committee summarizes its recommendations, and would suggest that the following recommendations be submitted to the Association for adoption by letter ballot:

1, That drawing for standard journal boxes, 3¾ by 7 inches, show size of bolt-hole 1 1/16 inch instead of 1 inch, to provide for the 1-inch bolt ordinarily used.

2. That Sheet 15, showing journal box in details, for journals 5 by 9 inches, give the general dimensions only for journal bearing, eliminating the general construction of bearing, with lead lining.

3. That the word "coupler" be substituted for "drawbars" in the title and description of the standard height of drawbars.

4. To eliminate guarantee for cast-iron wheels from the list of recommended practice.

5. Substitute the word "couplers" for "drawbars" in the title and text in connection with the recommended practice "Adjusting height of drawbars."

6. Eliminate the drawing and description of the Fletcher journal box lid for 80,000-pound capacity cars from the recommended practices.

The committee suggests that the following subjects be referred to committee to investigate and report at our next convention:

1. Design for wheel circumference measure.
2. Revision of specifications for car wheels.
3. Design for the journal bearing and wedge gauges for 80,000 and 100,000-pound capacity journals.
4. Revision of rules for loading poles, logs and bark on cars.
5. Revision of recommended practice on springs for freight cars, including the consideration of designs for springs for 100,000-pound capacity cars.

[The remaining reports will be printed in abstract next month — Editor.]

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.

THIRTY-SECOND ANNUAL CONVENTION.

ABSTRACTS OF REPORTS.

A Research Laboratory Under the Control of the Association.

Committee—G. R. Henderson, W. F. M. Goss, John Player.

1. The Need.—Each succeeding step in the development of a science broadens the outlook. When the facts which bind one condition to another have been fully ascertained, they immediately become stepping stones to new facts, suggesting new conditions, and giving rise to new questionings. Each achievement is a demand for new effort. The process is one of perfecting and has no end. Moreover, the problems arising in this process become more and more difficult as the work proceeds. Not only, therefore, is each achievement a demand for increased activity, but for more perfect methods as well.

The preceding general statements, applicable to the development of any science or art, are especially true of those branches of engineering which are represented by this Association. The past has had its problems; they have been met with masterful energy and many of them have been solved. Facts thus discovered give direction to present practice and constitute the promise of better things to come.

The most significant results which thus far have been presented to this Association are those which have been derived from carefully conducted experiments and study, a process which, for the purpose of this report, will hereafter be referred to as research. These, while they have benefited all roads alike, have been obtained as the result of personal sacrifice on the part of comparatively few members, and at the expense of a few roads.

The establishment of a research laboratory by this Association would be proof of its readiness to adapt itself to the demands of more exacting conditions, and would show in a fitting manner its sense of fairness in requiring contributions from all who receive benefit.

2. A Measure of the Problem.—At the present time there are in the United States, in round numbers, 36,000 locomotives, 33,000 passenger equipment cars, and 1,230,000 freight cars. These are probably worth nearly $900,000,000. In keeping this rolling stock in repair, there is spent in the neighborhood of $60,000,000 per annum, not including lubrication and such maintenance. It is thus seen that the value of the equipment and the annual charges for repairing it call for a great outlay of money, and yet there are thousands of points and questions in regard to the design of railroad cars and locomotives which should be cleared up, and upon which valuable (having a cash value) information could be obtained by the proper investigation, conducted in a thorough and reliable manner. One-tenth of one per cent. of the amount paid out yearly for keeping up the condition of the equipment would provide a handsome sum for the purpose of conducting such investigations as have been outlined above. The combustion of one-half billion tons of coal each year is no small undertaking, but the payment for the same is a still greater one. Even one per cent. (a value so small in a comparative test that it is disregarded) of the quantity would be five million tons! And there are hosts of inventors who claim that their productions will save many per cents. These suggestions are merely intended to emphasize the desirability of scientific examination into their merits. There are, of course, many directions along which the spirit of improvement may manifest itself; the present purpose is to urge the adoption of more extensive and equitable methods of developing such scientific facts as are needed to stimulate the deliberations of this Association, which, officially, is charged with the responsibility of maintaining the equipment of 200,000 miles of American railway, and to guide the practice of its members.

3. The Plan.—The committee makes no plea for the details of any plan of organization, but to give definiteness to its argument presents, in the form of an appendix, an outline prepared by one of its members, of the more important features of a plan which appears to be fundamental and safe. Reference to the appendix will show that a large initial investment is not thought necessary, the use of existing laboratories being proposed rather than the immediate establishment of a new plant. Such a plan appears to your committee not only wise, but it is one to which the Association, by its past practice, is already committed. By selecting one laboratory for one line of investigation and another for a second line, the co-operation of men and materials best suited to the needs of the Association would be secured.

4. The Cost.—The cost of organizing and maintaining such a movement, even on the limited scale proposed, would be considerable. Within limits, the results are likely to prove beneficial in proportion to the money which is put into the work. Great returns are not ordinarily expected from small investments. To insure a degree of success which will comport with the dignity of the society, the proposed organization should be assured of existence for at least three years, and money for maintenance during this period should be in sight. The minimum amount which your committee deems necessary for a period of three years is $40,000, of which $12,000 should be available during the first year, and $14,000 during each of the two succeeding years. If more could be provided, the returns would be still greater. During the period of assured existence the research laboratory may be relied upon to justify its existence to an extent which will thereafter be the means of supplying whatever may be necessary for its proper conduct. If it were to fail in this it would be time to stop expenditure.

5. Routine Work.—It is likely that the existence of an organization for research would lead to work of a routine character, such as examination of water, chemical and physical tests of materials, etc., for individual roads, especially for smaller lines which do not now maintain laboratories nor have engineers of tests. If undertaken at all, the cost of such work should be paid for by parties receiving benefit, and could, therefore, be self-supporting. Routine work, however, should not be undertaken at all along lines in which private laboratories are prepared to give satisfactory service at reasonable cost, for such work is distinctly less significant than that of research. The one may serve to keep practice up to known standards, but the other is the basis which serves to advance practice. A research laboratory, therefore, should not be drawn away from its high calling by the allurements of minor interests.

6. In conclusion, that the matter herein presented may receive proper consideration, your committee would recommend the passage of the following resolution, to wit:

Resolved, That in the opinion of this Association there is need of more concerted action in the development of such practical and scientific facts as are needed to direct practice in the design and maintenance of railway equipment; and,

Resolved, That the Executive Committee be and hereby is directed to carefully consider the plan for a research laboratory under the direction of the Association; and is authorized to formulate a plan of organization; to ascertain by what methods the necessary money can be assured; and, so far as may be practicable and expedient, to proceed with the actual work of organization; also,

Resolved, That in case the Master Mechanics' Association should become merged into, or consolidated with, the Car Builders' Association before action is taken under these resolutions, the persons who at the close of the present convention represent this body in an executive capacity, be and hereby are authorized and directed by this body to present the whole question covered by these resolutions to such Directors or Executive Committee as may hereafter represent the interests which are now intrusted to the care of this Association or of the two associations named; and be it further

Resolved, That it is the desire of this body to have presented a report of progress at the next annual convention of this Association, or at the next convention of such Association as may one year from date represent the interests of this Association.

Best Methods of Preventing Trouble in Boilers from Water Impurities.

Committee—A. E. Manchester, J. H. Manning, S. P. Bush, H. Bartlett, R. M. Galbraith.

[This report is voluminous and exhaustive. It covers a large field and owing to the impossibility of presenting it in abstract the conclusions of the committee only are reproduced.—Editor.]

Recommendations of the Committee.

The first effort in preventing trouble in boilers from water impurities should be in searching out sources of supply furnishing the best obtainable feed waters.

1. In building a water station where, by a larger first outlay, water of a better quality (that is, costing less for purification) may be obtained, the question should be carefully considered before accepting the poorer water in order to save first cost of plant. The treatment of water is expensive, and the cost will pay the interest on a large investment. For example, in a station furnishing 100,000 gallons of water in twenty-four hours, which costs 4½ cents per 1,000 gallons for purification, were it possible to substitute a supply costing but 2¼ cents per 1,000 gallons for treatment, an outlay of $16,425 would be warranted in order to bring about the change. The annual cost for purifying the 4½-cent water would be $1,642.50; for the 2¼-cent, $821.25; the difference in the cost for the two treatments being $821.25, which equals 5 per cent. on an investment of $16,425.

2. Where necessity compels the use of troublesome water there are few cases where by treatment, either mechanically or chemically, fairly good waters for boilers may not be obtained, the important consideration being the method employed. There are in the market numerous so-called water purifiers, purges, oils and boiler-cleaners, many of them absolutely worthless, others dangerous. It should be a rule never to allow the use of any compound for this purpose until its effects and dangers are fully understood.

3. The cost of purifying waters will always be cheap when compared with the use of waters which cause trouble in the boiler. The best methods to be employed can only be determined when the conditions are fully understood. The cost for water purification depends on the character of the water and the methods and reagents employed. Lime and soda ash are the cheapest of the effective and harmless reagents for this purpose, and direct treatment in the tender is the least costly method.

Waters carrying twenty-five grains of incrusting matter per gallon, five of which are sulphates, may be successfully treated with soda ash at a cost of about 40 cents per 1,000 miles of engine mileage, or about 6.12 mills per 1,000 gallons of water.

With engines equipped with blow-off cocks of sufficient num-

ber and correctly located, and with four per cent. of water taken blown out, in keeping boiler free from sludge, the engine may be safely and satisfactorily run from 2,000 to 3,000 miles between washouts.

Assuming the cost for untreated water to be 10 cents per 1,000 gallons, the 4 per cent. wasted in blowing out would represent a value of 4 mills per 1,000 gallons, or a total for treatment and waste of 10.12 mills. In this calculation no account is taken of the heat losses in the water blown out, and if the blowing out be done at the end of the trip, when the engine goes into the roundhouse for a layover, it should not be. But if on the road, a further cost equal to the value of the heat in the water wasted should be added to the other expenses for water purification.

In waters of the character and treated by the methods just referred to, the results that may be expected from engines in freight service is that 100,000 to 200,000 miles may be made between changes of flues, and that the life of fire boxes will be from eight to fifteen years.

Water with forty grains of incrusting matter, seven or eight of which are sulphates, may be treated in the same manner with fairly good results, but with an additional cost for reagents and blowing out in proportion to the increase in incrusting matter and sulphate.

Treatment of water in the station tank, as represented by the several cases already alluded to, costs for reagents from 2¼ to 4½ cents per 1,000 gallons, and we estimate the loss of water in cleaning the settling tank, and in blowing out to keep the concentration of alkali to a safe limit, to be as great as by the direct method. The first cost for the water station is greater and will be further increased by the introduction of automatic devices for delivering the reagents. On the other hand, the special advantages are that the treatment may be varied to suit each particular condition of water; also that the water freed from sludge will carry a greater concentration of alkali without trouble from foaming.

The cost for treatment of water by mechanical purifiers or cleaners is for the water and heat lost in blowing out. The blow-off cock is the active agent for purification in all mechanical cleaners; the part performed by the remainder of the devices is to assist in bringing mud within its reach.

An engine fitted with blow-off cocks, as shown in Fig. 5, which is the standard on the N. Y. C. & St. L. R'y, is, we believe, fully equipped with a good purifier.

When waters contain little or no sulphates, or where alkali is troublesome or earthy matter is in suspension, they may be successfully handled by mechanical devices.

We do not consider it safe practice, where sulphates are to be dealt with, to depend upon mechanical devices, except they be reinforced by chemical reagents for neutralizing the incrusting matter.

The cost for clarification of water by filtering or settling is for first cost of plant, the interest and maintenance of same. By the unaided method, the only other expense should be for attendant and water used in cleaning.

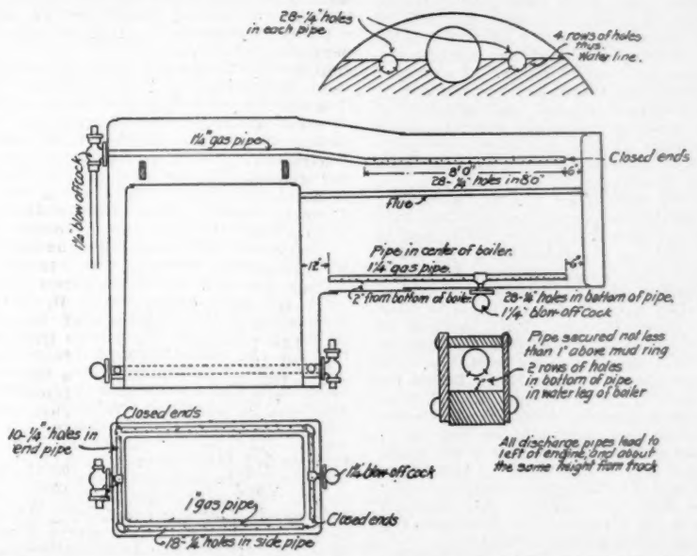
With the mechanical filter, the water used for this purpose should not exceed 5 per cent. of the amount pumped, and the time consumed in cleaning should be about fifteen to twenty minutes every five to ten hours. Where coagulants are used, there will be an additional cost for chemicals of 1 to 2 cents per 1,000 gallons of water clarified.

The cost of water purification by evaporation, as already explained, represents the most effective practice of the day. The practice given will be varied in proportion as the cost of labor and fuel be greater or less than the figures used in the case cited.

4. There should be on the staff of the Superintendent of Motive Power, where the size of the system will warrant, and boiler feed waters are troublesome, two specialists; one a boiler washing inspector, who has charge of the boiler washing. In the performance of his duties, he should as often as possible visit the different roundhouses and shops to see that they are equipped with and using the tools intended for this purpose; that the boiler washers understand how, and are doing good boiler washing; where soda ash put in the tender is the reagent and method employed for purification, to see that the correct amount is properly put in, observe the manner in which the blowing off is done, and to stay at each point until a personal inspection has been made of all boilers cared for by them.

The other specialist should be an assistant to the chemist, and should have a knowledge of the chemistry of water, and a good understanding of geology; the water supply of the system, so far as relates to quality, to be directed by him. Among his duties to be the searching for, and locating, the best sources of water, looking after the condition of water in existing stations, and where any falling off in quality develops, to determine cause. The analysis records and reports in relation to water purification and supply, and its performance in the boilers, to be under his charge. He should spend a part of his time on the road personally inspecting pumping and purifying plants and methods, and should keep in close touch with the boiler washing inspector, roundhouses and shops.

A man of this character, with a correct understanding and well directed efforts, would make himself useful in the department, and be the means of materially lessening trouble in boilers from water impurities.


28-¼" holes in each pipe
4 rows of holes thus. Water line.
1½" gas pipe
Closed ends
1½" blow off cock
8'0"
28-¼" holes in 8'0"
flue
Pipe in center of boiler.
1¼" gas pipe.
2" from bottom of boiler
28-¼" holes in bottom of pipe.
1¼" blow-off cock
Pipe secured not less than 1" above mud ring
2 rows of holes in bottom of pipe, in water leg of boiler
All discharge pipes lead to left of engine, and about the same height from track
Closed ends
10-¼" holes in end pipe
1½" blow off cock
1" gas pipe
Closed ends
18-¼" holes in side pipe

Arrangement of Surface and Blow-Off Cocks on Locomotives of N. Y., C. & St. L. R. R.

Relative Merits of Cast-Iron and Steel-Tired Wheels for Locomotive and Passenger Car Equipment.

Committee—J. N. Barr, H. S. Hayward, A. M. Waitt.

To the committee circular ten replies were received, two of which gave mileage information. These two reports were furnished by the Lake Shore & Michigan Southern and Chicago, Milwaukee & St. Paul Railways.

The Norfolk & Western Railway reports that cast-iron wheels are used exclusively except in the case of engine trucks. Here steel-tired wheels are used as a matter of safety. The price of a 600-pound cast-iron wheel is $4.85 as made by this company. This price does not include cost of superintendence or repairs of buildings.

The Chicago, Burlington & Quincy Railway, through Mr. G. W. Rhodes, says: "It has always been our practice to advocate cast-iron wheels made to Master Car Builders' specifications and tests when they do not exceed 33 inches in diameter, as being the cheapest wheel to use, and as safe a wheel as any steel-tired wheel." One exception is made to this: For engine trucks steel-tired wheels are used, as they are considered less liable to have brokn flanges. For wheels larger than 30 inches diameter, it is thought steel-tired wheels should be used, but have a number of 37-inch cast-iron wheels in service with no indications of breakage. In the last few months this road had two steel-tired wheels broken, one of which derailed a car. Tire was fastened by a Gibson retaining ring. A similar case has occurred with a cast-iron wheel recently.

The Lake Shore & Michigan Southern Railway, through Mr. Stevens, in addition to the information given on the statements, reports as follows: Average number of turnings for steel-tired wheels is two, and cost $1.25; steel-tired wheels are safer than cast-iron wheels; otherwise the relative merits are about the same.

The Lake Shore & Michigan Southern Railway, through the General Master Car Builder, report in addition to data given

in statements: Cost of turning steel-tired wheels, $1.62 per pair; average number of turnings, 4.

The Chicago, Milwaukee & St. Paul Railway report as follows: Cost of turning steel-tired wheels, $1.85 per pair; average number of turnings, 4. Steel-tired wheels are safer than cast-iron wheels for engine trucks, on account of tendency of these wheels to breakage of flanges. For all other service, their experience has been that cast-iron wheels are safer than steel-tired wheels. The actual number of breakages of such a character as would derail a car is greater for steel-tired wheels than for cast-iron, although about ten times as many cast-iron wheels as steel-tired wheels are in service. Steel-tired wheels are more expensive in both passenger car and locomotive service. The cost per 1,000 miles for steel-tired wheels is more than three times as great as for cast-iron wheels.

Your committee regrets that more information based on actual records was not furnished, as conclusions on this subject should be based on facts and not on unsubstantiated opinions. It should be remembered that the item of wheel service is the most expensive single item with which we have to contend. The mileage obtained from the best cast-iron wheels is fully three times as great as the poorest. The factor of safety in favor of the best cast-iron wheels as compared with the poorest bears at least an equal proportion. The same relation as to breakage exists as to steel-tired wheels. While the mileage relations of the various steel-tired wheels approaches much nearer to uniformity, it is not believed that this would be the case if the manufacture of steel-tired wheels were exposed to the same unbridled competition as is the case with cast-iron wheels. Again, the safety of trains from disaster, and even the life of human beings, is so dependent upon the quality of the wheels used that it would seem that railroads would not ignore the necessity of keeping a close watch and a full record of cases of breakages, with a view of eliminating from service wheels of doubtful quality. If it has been demonstrated that steel-tired wheels are safer than cast-iron wheels, railroads cannot afford to ignore this fact, and are without excuse for accidents arising from breakages, at least under passenger cars and locomotives, if the same are caused by breakages of cast-iron wheels, no matter what the difference in cost may be. If, however, there is no difference in the matter of safety, then the cost should decide the question. In the case of wheels, first cost is very far from deciding what is the most economical. Relative durability must always be taken into consideration. This can be done most definitely by keeping an individual record of wheels used and removed, and the actual mileage of the cars under which the wheels made their service. This method is cumbersome and many roads hesitate in going to the expense of maintaining such a record. The same results, however, can be approximated much more simply and with little labor by the following method: Make record, for example, of all tenders running with 33-inch cast-iron wheels; also of all wheels removed from these tenders during the year; obtain the mileage of these tenders for the same period and multiply by eight to obtain the total wheel mileage; divide this sum by the number of wheels removed, and the result will approximate closely with the actual wheel mileage obtained. While this method omits many details of importance, it gives actual results as a whole, and is much better than no information whatever.

Turning now to the statements presented with this report. [Not reproduced.—Editor.] There is considerable discrepancy in these reports; the L. S. & M. S. Railway report shows very much in favor of steel-tired wheels; the C. M. & St. P. Railway report shows in favor of the cast-iron wheels.

With the information as presented, your committee is unable to draw any definite conclusion, and would say that further information is required.

As to the comparative cost there is a decided discrepancy in the cost per 1,000 miles in passenger car service, partly due to difference in average mileage and partly to difference in relative value of new wheels and scrap. For locomotives the two reports agree much more closely, and if the discrepancies due to difference between cost of new and scrap wheels were removed the cost of service both for cast-iron and steel-tired wheels would be very close indeed, showing in both cases much in favor of cast-iron wheels.

In conclusion, your committee would say:

First—It is not able to decide from the facts presented whether steel-tired wheels are safer than cast-iron wheels, except in case of engine trucks.

Second—For engine trucks it would recommend steel-tired wheels from considerations of safety.

Third—Cast-iron wheel service is cheaper than that obtained from steel-tired wheels.

Fourth—It would recommend that at least the method detailed above be used for determining wheel mileage.

Fifth—That a careful record of breakages be inaugurated and maintained.

Advantages of the Ton-Mile Basis for Motive Power Statistics.

Committee—H. J. Small, C. H. Quereau, W. H. Marshall.

The following argument on the advantages of the ton-mile basis, made by Mr. Quereau, of this committee, clearly illustrates the desirability of using the ton-mile unit:

There are so many varying conditions, as the quality of coal, scale of wages, types of engines, water, grades, average speeds and the business to be done, that we believe it is unwise to attempt to compare the motive-power statistics of even different divisions of the same system, much less the different systems, except in the most general way. This conclusion is based on the assumption that the statistics will be compared with a view to bettering the records. We are fully persuaded that it is not only more just, but a better policy, and will secure much better results to compare the records of each division, or system, with those made by the same division, or system, during the same period of previous years.

So long as we rely on a comparison of records made by other divisions or systems, just so long will innumerable excuses be made concerning poor coal, bad water, light or heavy engines, grades, time, and a host of other unfavorable conditions which, whether reasonable or unreasonable, will be used by both officials and employees as good excuses for poor records and failure to improve. If the standard of comparison for each division is the previous record made by that division, the excuses which might be valid when comparison is made with some other division have little or no weight, because the conditions on each division are practically the same one year and another; or if there are noticeable changes, a proper allowance can be much more easily made, as they are well known to the men and officers on that division. For these reasons we believe it unwise to attempt to secure a uniform basis for motive power statistics with a view of making the records of all railroads comparable. We believe, however, that these reasons do not hold good in trying to secure the best basis for motive-power statistics.

It seems to us evident that the basis for engine-service statistics should be the work performed by our locomotives. This work includes the elements of time, distance and weight moved, and a perfect basis for motive-power statistics should include all three of these; under service conditions, however, it is practically impossible to include all three elements, except at a prohibitive expense.

If our statistics are kept under the heads of passenger, freight and switching, and the various runs classified under these heads, the variation due to the influence of time or speed will be very greatly reduced, as with this subdivision of the statistics, passenger records will be naturally compared with other passenger records, and freight with freight, and switching with switching. We believe that if this is done we can afford to neglect the element of time in the basis for our statistics, as such a classification of statistics will reduce to a comparatively small amount the influence of this element.

The loaded-car-mile basis, which is sometimes used, roughly approximates accuracy as far as distance and the weight moved are concerned, and, we believe, is much more accurate than the mile basis, but is far from ideal because of a great difference in the weights and capacities of cars; gives the same value to a load of straw hats and one of pig lead, and arbitrarily fixes the ratio between the weight of empties and loads.

We believe that these objections do not apply to the ton-mile as a basis for motive-power statistics. It is true that the ton-mileage, as obtained under the usual conditions, is not absolutely accurate; that it does not take into account the difference in the power required to haul a ton of grain in empty and loaded cars; that it is difficult, if not impossible, to obtain accurate ton-mileage records of local and stock trains. In short, the ton-mileage records as they are obtained under service conditions are far from perfect, but we believe this basis to be considerably more accurate than the mileage basis, and what is much more important, tends to encourage more economical methods of operating, while the reverse is true with statistics based on the engine-mile.

It has been objected that the ton-mile basis does not take into account the comparative resistance due to grades and speed, to the difference in the power required to haul a given weight of empty cars and loaded. We believe these objections apply with equal force to any other basis which may be used.

It has been stated that the ton-mile is a more accurate basis for engine statistics than the engine-mile because it is a more correct measure for the work done. An illustration will make this clear.

	March 1896.	March 1897.	Increase per cent.
Average miles per engine	2,282	2,289	$\frac{1}{3}$
Average ton-miles per engine	782,213	972,486	24

On the engine-mile basis the above statistics show that the engines did practically the same work in both 1896 and 1897, while those obtained from the ton-mile figures show an average increase of 24 per cent. There can be no doubt that the ton-mileage is a much more accurate approximation of the work done than the figures giving the average mileage.

Railroad men quite generally rely on the number of miles made to the ton of coal in determining their economy in the use of fuel. This basis is of comparatively little value, and may easily and naturally lead to wrong conclusions, because the fuel used is not compared with the work done.

The matter was aptly summed up by a master mechanic, who said: "When we were operating under the engine-mile system I was glad to see light engines going over my division, because they made my showing better; but now, under the ton-mile system, I dislike very much to see anything of the kind, because it hurts my record."

It would seem that the same line of reasoning which has been applied in comparing the merits of the engine-mile and ton-mile in the case of fuel, should have equal force when considering the proper basis with which to determine the cost of locomotive repairs, and lead to the same conclusion. If an engine goes over the road light, it is credited with as many miles as though it handled a maximum load, but there can be little chance for argument that in the former case the wear on the engine and the chances of a breakdown are a mimimum, while when worked to its capacity they are the greatest.

It seems self-evident that the cost of engine repairs per

mile will be least when the engines do the least work, and it can be readily shown that the cost per ton-mile will be least when the engines are worked to their full economical capacity. Therefore, the ton-mile basis, when used in determining the cost of repairs as well as fuel, places a premium on heavy trains, thereby fostering economical operating methods.

At first sight it would appear that there is no good reason for determining the cost of wages on the ton-mile basis, but we believe further consideration will show the contrary. As the cost of wages is now shown, so much per mile, there is no inducement to reduce the cost of this item per ton-mile of freight, because the item of wages, on the mile basis, will be the same on a division which may average five cars per train as on one where the average is five times this. On the other hand, if the wages are compared on the ton-mile basis, it is evident there is a strong inducement to reduce the cost of wages per ton by increasing the tonnage hauled.

If the arguments presented are considered sound, it would seem to be wise to use ton-mile as the unit of comparison for fuel, repairs and wages, or over 95 per cent. of the total cost of locomotive service. With this large percentage on the ton-mile basis, it would seem proper to use it as the basis for the total cost, and all the items. The fact that a railroad has ton-miles to sell, and not engine-miles, seems to me sufficient reason for keeping the cost of locomotive service on the same basis, so that a direct comparison of the selling and cost prices of their commodity can easily be made. It should not be inferred from this that we would advocate doing away with a statement on the engine-mile basis, showing the oil records made by individual engineers, for we believe this important.

Your committee is of the opinion that the present form of locomotive performance sheet, based wholly on the locomotive-mile unit and sent out generally over the country for purposes of general comparison between railroads, is misleading and unsatisfactory; and while it is almost unanimously conceded that the ton-mile unit for freight locomotive statistics is preferable, even this is unsatisfactory, as the expense of a ton hauled one mile over a mountainous road cannot be compared with that of a ton hauled one mile on a level road. Again, a road with few grades, good water and cheap fuel can make a much better showing in operating locomotives than another road with heavy grades, high-priced fuel and bad water.

The theoretical ideal system, perhaps, was that introduced by Mr. F. W. Johnstone, Superintendent Motive Power of the Mexican Central Railway, and in use on that road from 1884 to 1896. His system reduced all work done by locomotives to the unit of 100-gross tons hauled one mile over a straight and level track, the road being reduced to the equivalent of a straight and level track.

Your committee, after a study of the various methods of compiling and presenting locomotive statistics, are of the opinion that greater uniformity of practice is necessary, without which no satisfactory results can be obtained, also that the use of both the ton-mile and the locomotive-mile unit are necessary to properly exhibit all locomotive performance, the former for freight service and the latter for passenger, switch, and work service, and we have endeavored to present in the accompanying form [This is an admirable blank form which, on account of its large size, is not reproduced here.—Editor.] those features which seem to present in the most precise form the information required by all. This form provides for a summary of performances and expense for comparison between divisions of a system, or one system with another, as it seems clear that the requirements of the different roads in making up individual performance of locomotives are of more importance locally than they could be as a matter of comparison with other roads.

The Use of Nickel Steel in Locomotive Construction.

Committee—Tracy Lyon, P. Leeds, A. E. Mitchell.

This material was first brought into practical prominence at the time of the armor plate tests of the Government at Annapolis in 1890. It also came to be used by the Government for deck plates and stay bolts, but it was not until about 1896 that its use in this country began for locomotive construction; first in piston rods, crank pins, axles, and later in fire-box plates, side rods and stay bolts. Up to this time, however, nickel steel has only been used in locomotive construction in an experimental way.

Nickel steel is stated to be not a difficult alloy to manufacture, requiring no special furnaces, tools or thermal conditions. The cost of the nickel itself was, until 1875, $6 to $7 a pound, so high as to make its use for such a purpose impossible, but the opening in Canada of the most extensive nickel mines yet discovered has reduced the price to from 30 to 40 cents a pound.

Although nickel has been alloyed with steel in almost every proportion, what may now be called commercial nickel steel contains from 2 to 5 per cent. of nickel. Such a material possesses great uniformity, the nickel being uniformly distributed throughout the ingot and not subject to segregation like other ingredients of steel, although some of the earlier experiments seemed to indicate a tendency, with more than 2½ per cent. of nickel present, toward the formation in the heart of the ingot of long needle-shape crystals, which forging, hardening or annealing would not cause to disappear.

The addition of the nickel to steel adds particularly the qualities of toughness, durability and resistance to corrosion. Commercial nickel steel may possess the same elongation as ordinary steel with a tensile strength 30 per cent. higher and an elastic limit at least 75 per cent. higher. This greater strength, and particularly the higher elastic limit, would appear to make its use for structural material, boilers and machinery, far more advantageous than ordinary steel, especially where a saving in weight is desired and the parts are subjected to alternating stresses.

With increased steam pressures, boiler plates two inches and more in thickness are demanded, bringing with them serious difficulties in handling and construction which it may be possible to obviate by using nickel steel plates 25 or 30 per cent. thinner.

Most of the nickel steel made in this country contains about 3 per cent. of nickel, and it is stated that such material can be worked without difficulty; rolled, forged, pressed in dies without cracking, flanged, punched, welded and machined. There seems to be no doubt, however, but that nickel steel cannot be machined as easily as low carbon steel. It takes the edge off tools very rapidly and the finishing cut is apt to sliver. The best of machinery and tools are required to cut a clean thread on stay bolts. One authority says that an alloy containing 1 per cent. of nickel can be easily welded, but that with more nickel the difficulty of this operation increases. With more than 5 per cent. of nickel all of these operations become considerably more difficult. A French authority states that it requires ten times more time to corrode a 5 per cent. nickel steel when dipped in dilute muriatic acid than an ordinary soft steel containing 0.18 carbon. Other experiments, made by leaving planed plates exposed to the action of sea water for a year, showed a loss by corrosion of nickel steel plates of 1.36 per cent.; of mild steel 1.72 per cent.; wrought iron 1.89 per cent. A nickel steel has been offered for use for locomotive tanks on account of its non-corrosive qualities.

The Government specifications for the nickel steel propeller shafts of the U. S. S. Brooklyn required a tensile strength of 85,000 pounds and 50,000 pounds elastic limit. The Navy appears to be using nickel steel very extensively now and provides general specifications covering its present use.

An ultimate resistance of 90,000 pounds can be obtained from 3 per cent. nickel steel with very low carbon, say 0.175, when to obtain this strength in ordinary steel would require at least 0.50 carbon, sufficient to make the material so brittle as to be unreliable. It is claimed that with the right treatment an ultimate resistance of as much as 135,000 pounds can be obtained with steel containing about 3 per cent. of nickel. In general the elastic limit of nickel steel may be depended upon to be above 50 per cent. of the ultimate resistance.

A prominent American manufacturer gives the following specifications as proper for nickel steel parts of locomotives:

Specifications.

3 per cent. Nickel Steel.	Minimum Tensile Strength.	Maximum Tensile Strength.	Minimum Elongation	Elastic Limit.	
Crank pins	78,000	84,000	25% in 2 in.	½ of ultimate	Oil-tempered
Piston rods	78,000	84,000	25% in 2 in.	" "	
Driving axles	74,000	80,000	30% in 2 in.	" "	
Side rods	60,000	68,000	25% in 2 in.	" "	
Firebox plates ...	60,000	68,000	20% in 8 in.	" "	
Stay bolts	58,000	66,000	20% in 8 in.	" "	

Maximum P. 0.03, S. 0.03, Mn. 0.40, C. 0.25, Si. 0.03.

The suitability of nickel steel for tires is particularly mentioned. "The usual test of a tire is that it should stand compressing one-sixth of its diameter without cracking, but one of nickel steel stood compression from a diameter of 39½ to 19 inches without signs of fracture. A crack appearing in the metal does not develop as in carbon steel, and this renders it peculiarly applicable for shafts and axles."

The experience of one of this committee with two piston rods of commercial nickel steel would confirm in a way this latter statement. After having been in service for two years, transverse cracks appeared extending over about one-third of the circumference of the rods and of a maximum depth of $\frac{3}{8}$ inches. When removed, however, the rods could not be broken with the heaviest sledges, one being finally fractured in a hydraulic press, while the other had to be drilled in two. These rods appeared to be soft, and the wearing surface did not glaze over, although no unusual wear of metallic packing was observable.

A user of nickel steel locomotive crank pins states that there seemed to be quite a variation in the hardness of different pins in the same lot, as evidenced by the behavior of the metal under the tool, and that the reduction in diameter of the softer pins under the pressure of the burnishing roll was particularly noticeable. Another reports the trial of nickel steel bolts in place of iron (where the latter were failing and could not be made larger), but with no benefit.

A few members reported the recent use by them of nickel steel crank pins for locomotives, piston rods and fire boxes. Among the few comments made was one which referred to the rough appearance of nickel steel fire-box sheets, and another that it appeared, from a limited number of nickel steel piston rods in service, that they were more apt to break than those of ordinary steel. (No particulars given.)

It has not been attempted to touch on the use of nickel steel as a material for castings, but much may be looked for in that direction.

[The other reports presented at this convention will be printed next month.—Editor.]

EXHIBITS AT THE CONVENTION.

The following is the list of the companies exhibiting at the recent conventions at Old Point Comfort, Va.

Acme Pipe Clamp Co., St. Louis, Mo.

Acme Railway Equipment Co., Easton, Pa. Freight, passenger and locomotive couplers. Buffer platform vestibule; steel under framing for car platforms; McKeen carry irons and turn spring draft atachment. Represented by T. L. McKeen, manager.

Adams & Westlake Co., Chicago.

American Brake Co., St. Louis, Mo. Locomotive truck brakes and automatic slack adjuster.

American Brake Shoe Co. Diamond "S" brake shoes.

American Grain & Car Door Co., Philadelphia, Pa. American grain door, royal flush side door.

American Machinery Co., Grand Rapids, Mich. Oliver wood trimmers.

American Manufacturing Co., New York, N. Y. Peerless coupler.

American Steel Foundry Co., St. Louis, Mo. Models of trucks and couplers.

Atlantic Brass Co., New York, N. Y. A. B. C. journal bearing.

Automatic Air & Steam Coupler Co., St. Louis, Mo. Model of the device.

Baltimore Ball Bearing Co., Baltimore, Md. Anti-friction ball side bearings.

Bird & Son, F. W., East Walpole, Mass. Torsion proof car roof.

Bethlehem Iron Co., Bethlehem, Pa. Nickel steel crank pins, piston rods and axles.

Boston Belting Co., Boston. Samples of air-brake, steam and car heating hose, mats, matting.

Butler Drawbar Attachment Co., Cleveland, O. Tandem attachment.

Carborundum Co., Niagara Falls, N. Y. Carborundum wheels and specialties, cloth and paper.

Chicago Grain Door Co., Chicago. Chicago grain door and Security lock brackets.

Chicago Pneumatic Tool Co., Chicago, Ill. Pneumatic hammers, riveters, drills, wood borers, flue expanders, staybolt tappers, staybolt biters, staybolt riveters, speed recorders, hoists, heating forge, motors, self-closing hose couplers.

Chicago Railway Equipment Co., Chicago, Ill. National hollow brake beams, automatic frictionless side bearings.

Cleveland City Forge & Iron Co., Cleveland, O. Turnbuckle.

Cloud Steel Truck Co., Chicago, Ill. Cloud pedestal truck, Cloud pressed steel arch bar truck, Bettendorf I-beam body and truck bolster.

Corning Brake Shoe Co., Corning, N. Y. Brake shoes.

Crane Co., Chicago, Ill. High steam pressure valves and new air-brake union.

Crosby Steam Gauge & Valve Co., Boston, Mass. Waterback locomotive gauges, muffler and plain pop valves, chime whistles, spring seat globe and angle valves, Johnstone blow-off cock.

Dayton Malleable Iron Co., Dayton, O. Dayton draft rigging and the Dayton car door fastener.

Detroit Lubricator Co., Detroit, Mich. Detroit lubricators with the Tippett attachment, back pressure valves for steam chests.

Detrick & Harvey Machine Co., Baltimore, Md. Working model of Adam's bolt threading machine.

Diamond Rubber Co., Akron, O. Full line of rubber goods for railways.

Fairbanks, Morse & Co., Chicago, Ill. Combined gasoline air compressor and combined gasoline geared water pump, motor velocipede cars, track velocipedes.

Gardner Safety Window Sash Holder and Combination Lock and Lift, Newburgh, N. Y.

Goodwin Car Co., New York, N. Y. Five 80,000-lb. capacity steel cars, steel model of car, full size sectional drawings and photographs.

Gould Car Coupler Co., New York, N. Y.

Gumbo Cement Co., Chicago. Gumbo cement.

Greenlee Bros. & Co., Chicago, Ill. Special wood working machinery, tools and square hole borers.

Jones Car Door Co., Chicago, Ill. Car doors.

Johns Manufacturing Co., H. W., New York. Full assortment of asbestos goods.

Joyce Cridland Co., Dayton, O.

Keasbey & Mattison Co., Ambler, Pa. Magnesia and asbestos, samples of boiler and pipe covering.

Knitted Mattress Co., Canton Junction, Mass. Padding for car seats.

Lackawanna Lubricating Co., Scranton, Pa. Lubricators.

Leach, Henry L., North Cambridge, Mass. Locomotive sander.

McConway & Torley Co., Pittsburgh. The Buhoup three-stem freight coupler on two 80-000-lb. capacity cars.

McCord & Co., Chicago and New York. McCord journal box, McCord coil spring damper, Johnson hopper door.

Manning, Maxwell & Moore, New York City. Metropolitan injector, air compressors and pneumatic hoists, and Ashcroft steam gauges and consolidated safety valve.

Mason Regulator Co., Boston, Mass. Air-brake pump governor, balanced valves, pump pressure regulator, steam pump and other regulator appliances.

Michigan Lubricator Co., Detroit, Mich. Michigan improved triple lubricator No. 3 and automatic steam chest plugs; also air pump cups.

Monarch Brake Beam Co., Detroit. "Monarch" and "Solid" brake beams.

Moran Flexible Steam Joint Co., Louisville, Ky.

Missouri Railway Equipment Co., St. Louis, Mo.

National Coupler Co., Chicago, Ill. Couplers, draft rigging and platform buffers.

National Malleable Castings Co., Cleveland, Ohio. Tower couplers.

New York Belting & Packing Co., Limited, New York, N. Y.

Oval Brake Beam Co., Philadelphia, Pa. Brake beams.

Pantasote Leather Co., New York.

Peerless Rubber Manufacturing Co., New York. Air-brake hose, steam hose, engine and tender hose, gas hose, packings, rubber matting, etc.

Pearson Jack Co., Boston, Mass. Pearson jacks, Pearson kingbolt clamp, Pearson journal jack.

Pressed Steel Car Co., Pittsburgh, Pa. Pressed steel cars on government tracks east of the Hygeia.

Q. & C. Co., Chicago, Ill. Chipping, beading and riveting machines, Priest snow flangers, wood car seal.

Railway Appliance Co., Chicago. Emergency knuckles, car brasses, etc.

Rand Drill Co., New York, N. Y. Rand compressor.

Safety Car Heating & Lighting Co., New York.

Sellers, Wm. & Co., Philadelphia, Pa. No. 6½ automatic injector, model No. 87 improved injector, water strainer; model of 87 automatic machine showing a sectional view, also a full-size No. 87 injector in operation on grounds.

Simplex Railway Appliance Co., Chicago, Ill. Simplex bolsters for 80,000-lb. capacity cars, also same for 60,000-lb. capacity and short truck bolster for 60,000-lb. capacity cars.

Star Brass Manufacturing Co., Boston, Mass. Air and steam gauges, chime whistle and pop valves.

Sterlingworth Railway Supply Co., Easton, Pa. Trucks and brake beams.

Standard Coupler Co., New York. Standard steel platform, standard coupler—freight and passenger.

Thornburgh Coupler Attachments Co., Detroit. Draft rigging and coupler.

Tilden Co., B. E., Chicago, Ill. Railway replacing frogs.

United States Railway Supply Co., New York. Pottier & Stymus Company car seats and Pegamoid leather.

Universal Car Bearing Co. Chicago car door and universal brasses.

Walworth Manufacturing Co., Boston, Mass.

Washburn Coupler Co., Minneapolis, Minn. Couplers.

Waterbury Tool Co., Waterbury, Conn. Patent ratchet drill.

Westinghouse Air Brake Co., Pittsburgh, Pa. Air brakes.

CLEANING PASSENGER COACHES.

The appearance of clean and attractive cars is one of the best advertisements available for the passenger departments of railroads. The Modoc Liquid Car Cleaner is highly spoken of by many who are using it and a few suggestions will be valuable to those who are making efforts in this direction.

Cars having run through the shops to be revarnished during the winter will show three or four months' wear and should have immediate attention, as well as those coming out of the shops for general repairs. The great economy is in taking these cars in hand at once, not allowing them to run five or six months before cleaning, for then it will cost as much as though cleaned with soap and water which, often repeated, takes off the paint and varnish and costs an average of $5 a car, while if cars are cleaned regularly every 30 days after leaving the shops, they can be cleaned for $1.25 each. Fifty coaches running into any one terminal when treated in this way will always be clean and bright at a cost of $62.50 per month. Some roads clean their coaches semi-monthly, averaging 8 men to a coach, cleaning 3 coaches every 2 hours, this being done owing to the condition of the road or color of the cars.

It is useless to expect a cleaner to clean dirty coaches as well the first time as with soap and water, because if it was an article containing component parts so strong it would take but very few cleanings to eat all the paint and varnish off and would necessarily contain an acid, alkali or ammonia. The material referred to cleans rapidly enough, as the figures show, after the coaches have had their first cleaning, but if given a fairly clean coach to start with, it is possible to keep it up at the figures above given.

Cars that have been on the road without cleaning from 5 to 6 months get very dirty and should be first cleaned with Modoc powdered soap and then dressed with the liquid, afterwards using nothing but the liquid every 30 days, avoiding the use of water at all times, as it is injurious to varnish and does not clean; in the interim cars should be wiped down with dry or old moistened waste. One can readily figure out the economy in thus systematizing cleaning and not allowing cars to run so long as to necessitate the double expense of cleaning with powdered soap, then dressing with the liquid. Cars treated properly by cleaning regularly, as suggested above, taking them in hand right from the shops, or soon thereafter, will be kept at least 8 months longer on the road, and will always present an attractive appearance.

On cars with the dirt absolutely ground in and the varnish gone, it would be a waste of time and money to clean them with either powdered soap or Modoc liquid car cleaner, as they should go to the paint shop. A large number of cars that are sent to the shops for slight repair work should be given a thorough cleaning with the liquid before being turned out, thus insuring their being in a clean condition at once and they will look like new coaches and can be kept so. The regular and systematic method of cleaning coaches with the liquid should also be adopted for locomotives.